The

AUSTRALASIAN wireless REVIEW

PRICE 1/6

SENATORE GUGLIELMO MARCONI

G.C.V.O., LL.D., D.Sc., M.I.E.E.

Patron of the Wireless Institute of Australia

ELECTRICITY IS KING!

THIS IS THE ELECTRICAL AGE — IT
TURNS THE WHEELS OF INDUSTRY
IT TRANSPORTS US WITH INCREDIBLE
SPEED FROM ONE PLACE TO ANOTHER —
WHEN NIGHT FALLS IT ILLUMINATES
OUR WAY WITH ALMOST THE BRILLI-
ANCY OF DAYLIGHT — IT WARMS
OUR HOMES IN WINTER, RENDERS
THEM COOL IN SUMMER — IT
SEWS, COOKS, SCRUBS, DUSTS
WE COMMUNICATE WITH
FRIENDS FAR AND NEAR
BY ITS KINDLY AID

AND NOW, MOST WONDERFUL
OF ALL

IT BRINGS US MUSIC, SONG AND
STORY THROUGH THE AIR!

The

AUSTRALASIAN WIRELESS REVIEW

PUBLISHED MONTHLY

Vol. 1; No. 2 FEBRUARY, 1923 Price One Shilling and Sixpence

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ILLUSTRATIONS

The "Australasian Wireless Review" is forwarded to any address in Australasia for **10s.** *per annum*

All the line and half-tone blocks in this publication have been supplied by Messrs. Gulliver & Murch, Process Engravers, 208 Castlereagh Street, Sydney

Senatore Guglielmo Marconi,

G.C.V.O., LL.D., M.I.E.E.

SENATORE MARCONI was born at Bologna, Italy, in 1874. He studied at the Leghorn Technical School under Professor Rosa, and had keenly interested himself in all that had been done by the earlier experimenters in wireless signalling. At his father's estate at the Villa Griffone, near Bologna, he began experimenting in June, 1895, with Hertzian waves. Before long, he abandoned the Hertzian form of radiator, and, instead, connected a wire to a metal plate laid on the ground, and the other wire to a plate held on the summit of a pole. During the latter part of 1895, he was able to tranmit signals a distance of 1½ miles, using poles 25 feet high, and with tin sheets suspended on the poles. Before this time he had succeeded in improving the Branly coherer, making it more sensitive.

He also produced an electric tapping arrangement for decohering the coherer. The apparatus, in all, consisted of a coherer, a decoherer, a relay, and a Morse printing instrument, all worked with battery cells. Choke coils were interposed between the coherer and the relay, which greatly increased the efficiency of the receiving set. Across the relay and other contacts, he placed shunts, thereby reducing sparking to a minimum, so that it would have little, if any, effect on the sensitive filings of the coherer. The transmitting apparatus consisted of a spark gap of huge proportions as compared with the present type, on to which the aerial and earth wires were connected. An induction coil worked on batteries was employed for furnishing the high tension current to form the spark. His first spark gap was a ball discharger, composed of four solid brass balls, the two centre ones being seperated by a small space filled with vaseline, the spark jumping from the two end balls to the centre ones, which again broke the spark in the vaseline mass, producing a high frequency spark. By pressing the key at the transmitting end, a short or long dash was recorded on the paper tape.

In February, 1896, he went to England and lodged an application for the first British Patent for Wireless Telegraphy. In July of the same year, he conducted experiments in the presence of the British post office officials.

By March, 1897 he had covered a distance of four miles, and soon afterwards increased this to eight miles.

A demonstration was given before King Humbert, at the Royal Palace of the Quirinal, in July, 1897, when communication was maintained from the shore, to the Italian cruiser "San Martin," which was ten miles out at sea.

The first Marconi station was erected at the Needles, Isle of Wight, in November, 1897. On June 3rd, 1898, Lord Kelvin visited the Needles station, and sent from there, the first paid marconigram.

In the same year, the events of the Kingstown Regatta were reported by wireless telegraphy for the Dublin Daily Express, from the steamer "Flying Huntress," which was equipped with Maroni apparatus.

During the naval manoeuvers in July, 1899, three British warships, fitted with wireless, interchanged messages at distances up to 74 nautical miles (about 85 land miles.)

In 1900, 26 warships and six Admiralty shore stations, were fitted up with wireless apparatus.

By 1902, messages were received over a distance of 2,099 miles, and wireless communication over long distances, had become an accomplished fact.

Senatore Marconi is Patron of the Wireless Institute of Australia.

NELLIE AND SARAH KOUNS

believed Guglielmo Marconi when, in 1914, he told them that some day they would sing to hundreds of thousands by radio telephone. The phrophecy came true as they now sing for Broadcasting Studios

Answers to Correspondents

To "M.Y.": We agree with you that it is time broadcasting started and that everybody seems to be waiting for someone to take the initiative. Why not endeavour to form an Association of Radio Supplies Dealers, and go into the question immediately? We can hand you the name of one dealer who is willing to join such an Association, for a start.

To Neville T. Moore: Thanks for your appreciative and eulogistic letter. Your various suggestions are carefully noted. Our plans for the future include a scheme for considerably enlarging the Review, which will be sold at the same price. With more space available many features will be included which we cannot possibly find room for at present. We want you all to send us all the subscribers you can—and we will do the rest.

To J. C. King, Dalley, Queensland. You would be well advised to take no notice of advertisements such as you enclose. If you have an invention pertaining to wireless apparatus you can secure the necessary patents through any reliable patent attorney. Before spending any money on patents, you should have someone to advise you as to the commercial value of what you have in hand.

To Lindsay L. Lizar (Redcliffs, Mildura, Vic.): Your letter arrived just as we were going to press with this number of the Review. In our next issue we will publish details and description of a three-valve receiver, which has been thoroughly tried out by us, and which we are sure will serve your purpose admirably.

Nellie and Sara Kouns

After the outbreak of the great war in 1914, a big ocean liner was returning to New York from Europe.

The famous Kouns sisters, Nellie and Sara, were homeward bound from Europe with members of their family. On the same vessel was the great Marconi, and it so happened that the Marconi party became acquainted with the Kouns group, and Marconi himself took the sisters to the wireless cabin of the ship, explained the working of the wireless installation, and he told them that some day they would be singing to thousands at once by means of such apparatus.

To-day Nellie and Sara Kouns are probably the most popular vocalists singing for radio broadcasting in America.

Their voices are so much alike that they are called the "mirror-voiced sopranos."

On board the liner the Kouns sisters carried with them a gramophone and some records of their own making. Senatore Marconi remarked on the similarity of their voices, and asked them to put one of their own records on the gramophone. "See if you can guess who is singing, and when one stops and the other takes up the song," the Kouns sisters urged him. He did his best to guess while the record played, but only revealed his confusion, for, except when they were singing together, it was impossible to distinguish between the voices of the two sisters.

Remembering the prophecy made to them by Marconi nearly ten years ago, and realising how it has been fulfilled, they are confident that when the development of the radio-telephone has progressed to a more advanced stage, it will be possible and feasible to transmit the voice half-way round the world.

"We feel the time will come," said Nellie, "when people in all parts of America will hear the voice of a Chinese or Japanese girl singing in the far-off Orient."

"Yes," supplemented Sara, "and Italian music, too, straight from Italy—and French and German." And then they pictured a rosy scene wherein all the world was a single unit with one common aspiration—the universal desire for art!

And the radio-telephone, they say, will be the medium through which this long-sought goal will be attained.

Nellie and Sara Kouns were born in Topeka, Kansas, U.S.A. They are daughters of the late Charles W. Kouns, former general manager of the Santa Fe Railway. They received their initial musical instruction under American teachers; then they went to Germany to complete their studies.

Their only object in studying music was to secure the personal pleasure and satisfaction that a knowledge of it brings; the idea of going on the professional stage was far removed from their thoughts and from the thoughts of their father. When they were offered engagements at the Royal Opera at Munich, he withheld his consent, and to make certain that they would not yield to the temptation of this splendid offer, he made a special trip to Europe and brought them home during the early days of the war. It was on this trip back that the prophecy was made them by Senatore Marconi, as related in this story.

Friends finally prevailed on Mr. Kouns to allow his daughters to appear in concert, and their debut took place in Chicago.

A tour of the American Continent followed, that created a wave of enthusiasm for the sisters. Under the auspices of the Y.M.C.A. they went to France to entertain the American soldiers. At the Paris Opera, in Nice, Cannes, Monte Carlo, and in the Army of Occupation on the Rhine, their voices were heard, and they became great favorites with the American Expeditionary Force.

A professional season in England and France followed in 1920, and left in its wake a trail of ever-increasing popularity. In the spring of 1921 they returned to New York, and towards the end of that year commenced to sing for radio broadcasting at one of the leading studios, much to the delight of American radio audiences.

Editorial

THE PATENTS SITUATION

The development of a radio apparatus manufacturing industry in Australasia is retarded by reason of the fact that Australasian manufacturers do not know where they stand regarding patents. There is a kind of fear in the air, perhaps undefined, but, nevertheless real, that any Australasian manufacturer commencing the construction of radio apparatus, may be subjected to litigation and be put to heavy legal expenses. The industry would employ thousands of Australasian workmen if the position were clear and unambiguous. This "cat and the mouse" situation is not in the best interests of Australia—it is not good for Australasian industry. The retardation of Australasian industry has its reflex action in that radio service for the people of Australasia is also retarded.

The manufacturer wants to know if he is free to make up a receiving or a transmitting set, or, what are the conditions under which he can construct and sell such sets. What is definitely known in this connection is that the Lodge Loading Coil Patent and the Marconi Four Circuit Tuning Patent have expired, and that, in consequence, anyone may now manufacture loading coils, or apparatus for a tuning circuit in which the transmitter has the antenna system coupled to the oscillatory energizing circuit and each of the circuits tuned to resonance. At the receiver, the antenna system is coupled to the receiving circuit, and the circuits tuned to resonance with the circuits at the distant transmitter. This makes it clear that a valve receiver can be manufactured which has, as a tuning inductance, a loose-coupler, a plain or bank-wound vario-coupler, or a pair of honeycomb coils, when the secondary coil of any of these inductances is used for the purpose of energizing the grid circuit of the system. It does not, however, include using the secondary of the inductance as a feed-back coil in the plate circuit, the latter being covered by the patents of Major Edwin H. Armstrong. In other words, a circuit including regeneration cannot be used, the circuits mentioned being plain detector circuits. To a simple, non-regenerative circuit, a one, two, or three stage audio-frequency amplifier may be added, and the result is said to be clearer and more simple concert reception. As regeneration is not required in a radio-frequency amplification circuit, one or more stages of radio-frequency may be employed in the receiving set also, if desired. The average purchaser of a receiving set will want to add, sooner or later, radio or audio-frequency amplification, or both. It is best, therefore, to sell him a receiver in sections, and avoid patent troubles by so doing. The first section should be a tuning panel, having as an inductance, either a bank-wound vario-coupler, with a wave-length range of 150 to 3000 metres, or a three-coil honeycomb coil mounting, covering all wave-lengths, a condenser for the aerial circuit, and another for the secondary circuit. The second section should be a valve panel, having the valve, grid condenser and grid leak, rheostat, and "B" battery. A third panel should have two or three stages of audio-frequency amplification, and a fourth one, the same number of stages of radio-frequency amplification. The panels should be uniform in size in all measurements, and the connection made between them by terminals directly opposite to each other, and joined by brass straps.

As regards the Armstrong Patents, Major Armstrong has issued a number of licences to manufacturers, and we are given to understand that he is willing to licence all and sundry to use his patents.

By the time our next issue appears, we hope to be in receipt of a letter from Major Armstrong, telling us what the position actually is.

In the meantime, if any manufacturer is contemplating putting radio apparatus on the market and desires to know if he can use the Armstrong regenerative circuit in his receivers, he can communicate with Major Armstrong's solicitors, who are Messrs. Pennie, Davis, Marvin and Edmonds, 165 Broadway, New York City, U.S.A.

THE REGULATIONS

The Regulations pertaining to Wireless Transmission and Reception were published after we went to press with the last issue of the "Review." Copies may be obtained in Sydney at the Commonwealth Bank Buildings, Enquiry Office, 5th Floor, for 1/3.

As affecting amateurs, three kinds of licences may be issued:—

1. Broadcasting Station Licences.
2. Experimental licences for transmitting and receiving;
3. Experimental licences, for receiving only.

A Broadcasting licence may be granted in respect of a station operated for the purpose of disseminating news service or entertainment service. The station must be operated by a certificated operator or competent person approved by the Controller, and he must sign a declaration of secrecy of wireless communications. The station must be equipped with receiving apparatus. Broadcasting advertising matter is not allowed.

Experimental licences may be granted to Technical Schools and similar institutions, radio clubs approved by the Controller and for instructional purposes or for purposes of scientific investigation of wireless telegraphy or telephony phenomena.

The application of one under 21 years of age must be countersigned by a parent or guardian, who will be responsible for observing the conditions of the licence.

The applicant for a licence must indicate the nature and object of the experiments which he desires to conduct, and satisfy the Controller of his ability to conduct experiments scientifically, and to adjust and control his apparatus. If required, he must submit himself for examination, the fee being 5/-. If the application is for a licence to transmit, and in such other cases as the Controller may decide, the applicant must be capable of operating Morse at a speed of twelve words per minute, both sending and receiving.

The Controller is to determine conditions with regard to wave-lengths, power, etc.

The Controller may grant a temporary permit for a demonstration of wireless telegraphy or telephony in connection with lectures, entertainments, or any such proceeding calculated to assist the development or public appreciation of the art.

The period of the licence will be one year, and may be renewed from time to time.

The fee for a Broadcasting licence is £5, for a transmitting and receiving experimental licence £1, for receiving only 10/-.

In all cases a statutory declaration must be made regarding the secrecy of wireless communications.

No person may supply wireless apparatus unless the purchaser produces evidence that he has, or is about, to obtain a licence, and a register of sales must be kept by the radio apparatus dealer.

Applicants who propose using valve receivers at places within 5 miles radius of a commercial or defence station will not, except in special cases, be permitted to use regenerative circuits, and must be capable of receiving Morse at 12 words per minute. If a person is not able to comply with the latter condition he may have some person in attendance during the operation of the set who is capable of receiving such signals. Certificates of such capability will be accepted from the Secretary of a Wireless Institute, Officer in Charge of a Wireless Station, Postmaster or Instructor in a Telegraphy School, or School of Army Signalling.

A Transmitting Station must also be a Receiving Station, and be operated by a competent person, who must be capable of reading Morse at 12 words per minute.

Within five miles of a commercial or defence station, no transmission will be allowed, except in specially approved cases, and the anode power in a valve transmitter must not exceed 10 watts.

I.C.W. transmission will be permitted in certain cases.

Five to fifty miles distant from commercial and defence stations, any system of transmission will be allowed with 25 watts power in the anode circuit, of a valve system. With spark transmission, the same power will be allowed, measured in the Manual key circuit.

Over 50 miles, any system of transmission with power up to 250 watts will be permissible.

Wave lengths of transmitting stations, 150 to 250 metres for spark, I.C.W., C.W., and telephony; 410 to 440 metres for spark, C.W. and telephony only.

Amongst other things, the applicant for a broadcasting licence must state the wave-length in metres to be used in broadcasting, so it is evident that each case will be treated on its merits and the wave-length applied for viewed from the standpoint of how other stations will be affected.

On the whole, the regulations do not seem to have been framed with the object of bringing radio service to the general public of Australia, but in these, as in all regulations, much depends upon the spirit in which they are administered. Radio apparatus dealers seem to be unnecessarily harassed in having to ascertain that a purchaser has a licence or is about to obtain one, and in having to keep a register of sales. The purchaser

is already, by the Regulations, liable to severe penalties if he has wireless apparatus in his possession without having a licence, and this should meet all reasonable requirements. The clause is so easily evaded by a licensee purchasing for one waiting for his licence, that it is, from the beginning, abortive, so why put dealers to such unnecessary trouble?

In connection with those using valve receivers, the regenerative circuit should be permitted in all cases where the applicant can prove that he can properly control it, especially if radio-frequency is used in the receiver. Provision for this may be intended in the words of the clause "except in special cases."

The enactment that those who use valve receivers should be capable of receiving Morse at 12 words per minute, is one that might easily be amended without any ill effects. The person who wants to use a valve receiver for concert reception, usually has not the time to learn the code, but he should not be barred from the benefits of radio service. A simple "stop" signal of, say, six dots, six times repeated, would convey to all listening in that important messages were in transit, and would be just as effective as a 12 words a minute message; in fact, it would bring about a halt very much quicker, and the signal mentioned could be learned by anyone in five minutes. With transmitting systems, it is a different matter, as an applicant for a transmitting licence would want to know the code for his own benefit before contemplating the installing of a transmitting set.

However, the regulations are broad enough to permit the Controller to exercise considerable discretion, and if they are administered in a liberal spirit, all may be well, and, later, he may see his way clear to recommend such relaxation of the regulations as may secure the benefits of radio educative and entertainment service to all and sundry, whilst preserving all that is absolutely necessary to protect the defence and commercial services.

BOOMING THE BOOM.

NOW that the Regulations are out, and the air considerably cleared regarding the patents situation, all that is necessary to get the Boom going in full swing is a little initiative and energy, just a little healthy optimism and confidence in ourselves.

From New Zealand comes the news that radio is booming over there. Demonstration Radio Concerts are given each Saturday evening in the Town Halls in some of the leading cities, so that the public are given an opportunity to learn what is possible in radio concert reception, and what may be expected by possessing a receiving set. In Lambton Quay, Wellington, N.Z., three large radio supplies stores have been opened—all of them doing a roaring business.

The first thing necessary is broadcasting. In this respect everybody seems to be waiting for some one else to start. Surely we have some big firm in each large city with sufficient perspicacity to judge that a broadcasted radio concert is one of the finest forms of advertising! Once people can listen in to a broadcasted radio concert every evening in the week, there will be such a demand for receiving apparatus as will tax the resources of every present or prospective radio apparatus dealer to the limit.

In every town and city there are hundreds of good amateur vocalists and instrumentalists who would give their services free, one night a week, for radio concert purposes. The gaps could be filled in by carefully selected grammophone records, and the dealers should be glad to advertise their records by means of radio broadcasting, and supply programmes from time to time free of charge. Bands could be induced to conduct a practice night in a broadcasting studio, giving listeners in the benefit of their performances. Just a little organisation required to set the ball rolling—that is all.

In America nearly sixty newspapers broadcast news at different hours of the day—is there no newspaper in Australasia capable of rising to the occasion and helping the Boom along? Surely there is!

Start broadcasting, start public demonstrations of radio concert reception, and the general public will soon avail themselves of the healthy and uplifting influences of radio service.

There may be some difficulty in organising radio concert programmes for broadcasting from the country towns, but in each of those towns there is at least one large store that could instal a powerful receiving set, on which to receive broadcasted concerts from the larger cities. The concerts could then be amplified to any extent desired, and re-broadcasted to serve a radius of, say, 50 miles, with broadcasted concert as powerful as that sent out from the original stations in the cities. In this way radio enthusiasts with single valve or crystal detector receivers could receive as good as radio service as those who are situated within easy range of the big cities. A network of such re-broadcasting stations could bring city radio service to the people of the outback country districts, for their benefit, instruction and amusement.

The Coming Trans-Ocean Tests

THE Trans-Pacific Tests to be held in May next will afford Australasian amateurs an opportunity of making a name for themselves in the radio world. Both British and American experimenters will watch with interest the attempt to bridge 8000 miles of ocean with one kilowatt of power on a 200 metre wave-length. Radio experimenters here should do what they can to make the tests a success.

This they can do in two ways. First, they can enter for the tests, and, second, those who do not enter can refrain from operating their sets during the hours the tests will be proceeding, so as to reduce the chance of "interference" to a minimum.

We feel certain that every amateur will recognise that he should either take part in the tests, or, on the other hand, help those taking part to get the signals through. Any amateur listening in and not taking part in the Tests is liable to cause, perhaps unwittingly, such interference with his valve or valves as may render nugatory the efforts of those who are attempting to receive the American signals. The occasion will be one on which every experimenter will be on his honour to aid in establishing a standard for the Australasian experimenter, and to prove to the world at large that he has reached as high a grade in radio science as amateurs in other countries at least. If we are successful in getting the signals through, we will all be proud of the achievement, even though our own share in the result has been merely to give the successful ones the right of way to get into touch with our fellow-amateurs of America.

The time each night, during the course of the tests, when experimenters will be requested not to operate their receiving sets will be announced in due course, and probably not more than an hour will be required on each evening, so that no very great hardship will be entailed.

As many as possible should enter for the tests, for, in addition to the honour of getting the signals through, a number of prizes will be given to the successful contestants. Many of the prizes have been donated already, and these will be supplemented out of the surplus funds of the Organising Committee. The entrance fee has been fixed at 10/- for each station, and any number of experimenters can be entered under one station, so that a club may enter as one station, and any number of its members take part in the reception of signals. The closing date for entries has been fixed for the 28th February, 1923, but it will help the committee if the entrance fee and application form are forwarded without delay.

The Trans-Pacific Tests Organisation Committee was formed at a well-represented meeting of wireless experimenters held in Sydney on December 6th last, to carry out the necessary organisation of the Experimental Wireless Stations in New South Wales, and the officers elected were:—Mr. Malcolm Perry, Chairman, N.S.W. Section; Hon. Secretary and Treasurer, Mr. F. H. Harvey; Committee, Messrs. E. Bowman, A. W. McKellar, G. Thompson, G. Tatham, R. H. Howell, and E. Lavington.

The committee has issued two forms, one for the experimenters desiring to take part in the tests, and another for those not taking part, but who are anxious to assist those receiving the signals by closing down their stations during the hours the tests are being carried out.

It will greatly assist the work of the committee if every experimenter will sign one or other of the two forms, and send it in at the earliest possible moment. Forms should be addressed to the Hon. Secretary, Trans-Pacific Organisation Committee, "Lourdes," Nelson Bay Road, Bronte, Sydney. Telephone enquiries may be made at either Randwick 93 or Waverley 1308.

Individual amateurs can help the committee by bringing the forms under the notice of their radio friends, and by getting as many of them as possible sent in at the earliest date.

The Ford Car as a Wireless Transmitter

MANY and varied are the stories at present being told regarding the Ford car. From the immaculate clubman to the humblest comedian, the name of Henry Ford is considered fair game wherever motor-car stories are broached as a topic of amusement.

But the statement that the Ford car is a transmitter of wireless waves, which are detected by sensitive valve receiving apparatus, is not given in a spirit of levity, but as a cold fact.

The magneto of the Ford is of peculiar construction, corresponding very nearly to the high-frequency dynamo employed by wireless stations for the radiation of messages.

The coils might be considered the equivalent of the high-tension transformers, and the sparkling plugs as similar to the wireless spark transmitter. The sharp click of the ignition sparks are clearly audible in a wireless receiver's telephones, when a Ford car is some hundreds of yards away.

The signals thus received from the sparking plugs of a Ford car are so clearly defined that it is possible to detect a misfiring cylinder on the car by this means, without even having seen the car.

It has always been understood that the Ford car possessed certain advantages enjoyed by no other make of automobile, but that it numbers among its various accomplishments that of a wireless transmitting station, as well as a means of conveyance, certainly seems to be the strangest story of all.

The Trans-Pacific Tests

Some Suggestions by W. B. VEITCH, Technical Expert of the Magnavox Company

PROBABLY the subject which is of greatest interest to wireless experimenters at the present time is the design of apparatus to receive the Trans-Pacific Tests in May next, and already a number of amateurs are collecting information and commencing to make up the apparatus with which to try their preliminary experiments. While to some this may appear like rushing the early doors, it should be remembered that Australian amateurs are confronted with a much more difficult problem than that with which the British experimenters had to grapple—and those seriously considering attempting the reception of Trans-Pacific Test signals would be well advised, perhaps, to follow the example set by the early birds. With only one kilowatt at the transmitting end, the experimenter can immediately dispose of the idea that a good detecting valve and low frequency amplification will produce the desired result. To be definitely convinced that something much more elaborate must be used, one has only to remember that the rectified current in the plate circuit is proportional to the square of the received oscillations. That is to say, that if the amplitude of the oscillations in the aerial is halved, the rectified current is reduced to approximately a quarter. A 200 meter wave originating in America cannot be expected to induce in the receiving aerial, currents of large enough amplitude to operate a rectifying valve, and we must, therefore, turn our minds to the problem of finding the best method of amplifying the aerial current before rectification is attempted. Perhaps it might be as well to enumerate the different types of high frequency amplifiers which may be employed, and to touch on the characteristics of each in turn.

DIRECT MAGNETIC (REACTANCE CAPACITY) COUPLING.

Direct magnetic coupled circuits may be either aperiodic or tuned. Stronger signals will be received on the tuned circuit, but the aperiodic circuit has the advantage of covering a greater range of wave lengths without requiring any adjustment. To ensure the aperiodicity of the coil, the turns should be well spaced and resistance wire or wire of very small gauge may be used. The tuned circuit, in addition to being more sensitive, will also be found to be highly selective.

In Fig. 1 below a variometer may be used instead of the oscillatory circuit "XY" shown in the plate circuits.

For a 200 meter wave the plate circuit inductance should be approximately 70 microhys., and this may be obtained by winding 30 turns of No. 18 d.s.c., on a former having a diameter of 3in.

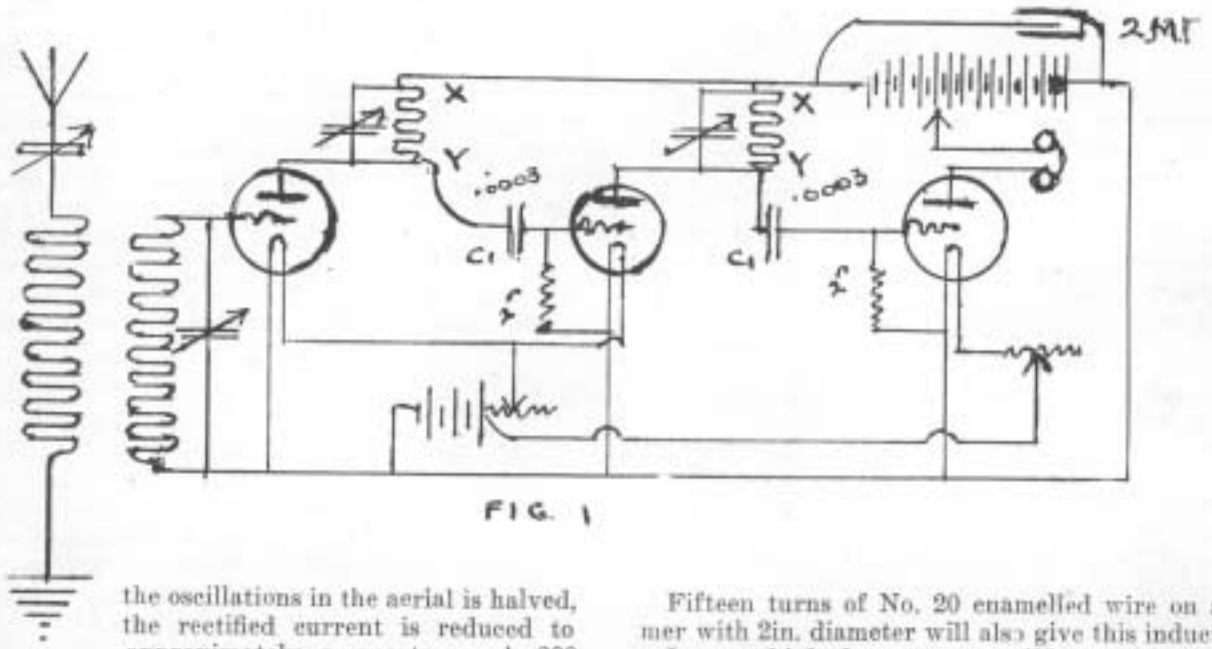


FIG. 1

Fifteen turns of No. 20 enamelled wire on a former with 2in. diameter will also give this inductance.

In any high frequency amplifier which employs one "B" battery to supply the potential for the plates of all the valves, it is advisable to join a 2 mf. condenser across the "B" battery to provide a path of negligible resistance for the passage of the high frequency currents. Without this there is a tendency towards reaction due to the fall of potential across the resistance of the battery.

INDIRECT MAGNETIC (TRANSFORMER) COUPLING.

This type of circuit is very suitable for short wave reception, and, like the direct magnetic system, may be used either tuned or untuned. For the reception of the Trans-Pacific Test signals the tuned circuits are strongly recommended, on account of the advantages gained in sensitiveness, the elimination of atmospherics and undesirable signals.

The tuning of both the primary and the secondary windings of the transformer is a cumbersome and unnecessary elaboration. If properly designed transformers are used, the wave lengths in both circuits are varied together when the capacity of a condenser across the primary is varied.

Of the two magnetic couplings, the writer is of the opinion that the "balance of advantages" lies with the reactance capacity method.

The condensers C1 serve to keep the potential of the "B" battery off the grids of the valves, and, at the same time, allow the passage of the high frequency currents through them. It has been argued that when transformers are used, the capacity effect between the windings constitutes the coupling. With very close coupling between the transformer windings, the capacity may be appreciable, but, at least, with loose coupling, there is no doubt but that the electro-magnetic induction effect predominates. The circuit shown in Fig. 1 is sometimes called a rejector circuit because it offers a high resistance to currents of the frequency to which it is tuned. This being the case, the nearer the plate oscillatory circuit is tuned to the incoming wave, the greater will be the difference of the potential across the ends of the winding, and since this winding constitutes the 1 to 1 transformer the greater will be the difference of potential existing between the grid and filament of the valve to which it is coupled.

(To be continued.)

The Latest Marvel of Radio Research

WHEN engineers of the Bell Telephone system accomplished the first transmission of speech across the Atlantic in 1915, they used 300 valves, not much larger than the ones in your radio set, to generate the necessary high frequency power. Since that time developments have gone on in the Bell System Laboratories of the Western Electric Co. in New York, resulting in the manufacture of valves of the same general type which will supply 250 watts and more. Two of these 250-watt valves generate the power for the larger broadcasting stations. Now the telephone laboratories have developed a valve capable of supplying 100,000 watts, or 200 times the power required for the usual broadcasting station of 100-mile range.

The essential feature of the new valve is that the "plate" is a copper cylinder forming the outer wall of the valve. In the customary valves used in radio sets, the "plate" is an actual plate or small cylinder of thin metal enclosed in a glass tube. If even a small fraction of an ampere is passed through the plate circuit of one of the small valves the plate will become very hot. In the larger "power" valves this heat becomes so great that some means other than radiation must be provided to carry it off, or the valve will collapse. This is easily done when the plate is the outer wall of the valve, for it can be put into a tank of water which circulates through a radiator. The valve is then water-cooled just like an automobile engine.

This sounds easy enough. The real difficulty was to make the whole valve air-tight and to get the wires

Mr. W. G. Houskeeper

for the filament and grid into the valve while keeping them insulated for about 20,000 volts. After much study the problem was narrowed down to finding a way to make an air-tight joint between the heavy copper tube which forms the "plate" and the glass of the upper part of the valve, and to bring the heavy wires through this glass. Credit for the answer is due to Mr. W. G. Houskeeper, a Western Electric Company's engineer, who discovered a way to seal copper to glass which would make an air-tight joint that would not crack at any ordinary working temperature.

One of these big valves stands three feet high and is three-and-a-half inches in diameter at the bottom. To heat the filament, for which in radio receiving tubes a single dry cell or small storage battery is enough, this valve used 6000 watts. For the plate circuit, instead of the familiar "B" battery, a high-voltage direct-current generator is used, or an alternating current rectifier.

The significance of these big valves is that only a very few would be necessary to operate even the largest radio stations now in service. The combination of valve and its current supply, it is expected, will be less costly, more rugged and more easily adapted to various wavelengths than any other source of radio power now in use.

This 100,000 watt radio valve, is a triumph of scientific research, and its development is likely to make it as easy to converse by radio telephone between Australia and America or even Great Britain, as it is to speak across a continent by land lines to-day.

Another Radio Triumph

IN order to comply with the desires of steamship passengers to converse by telephone with people on land, the Radio Corporation of America, The American Telephone and Telegraph Co., The Western Electric Company, and the General Electric Company (U.S.A.) recently participated in tests made with a view to ascertain the possibilities of a radio telephone system which would permit the speaker to talk and listen, without having to manipulate switches, just as one talks, or listens, in an ordinary land telephone.

In the early development of wire telephony, the receiver was also the transmitter and it was necessary for the telephone user to place the instrument to his ear to listen, and then hold it to his lips to talk.

Radio telephony has passed through a period of development similar to that of wire telephony. The majority of radio telephone equipments require the user to operate a push button to change from the transmit to the receive condition. So long as only radio operators, or persons more or less familiar with radio equipment, operate the apparatus, this switching feature was not so objectionable. However, it would not be reasonable to expect the general public to operate the switch at the proper time. The new system of duplex radio telephony permits sending and receiving simultaneously as with the ordinary land telephone. Interchange of thought is far more rapid between the two participants if one conversant can, at any moment, interrupt the other. Otherwise a conversation may lose coherence and the transmission of a long message may often entail irksome repetition. The greatest need for duplex radio telephony is in those installations where the equipment is used by the general public. This condition arises in providing communication between ships and shore stations.

Ship to shore telephone communication, in order to render the maximum amount of service, must be capable of being linked up with the regular wire telephone system. With such an arrangement a passenger on board a ship may converse with parties on shore, so long as the latter have access to a telephone. Thus a business man, sitting at his desk and using his ordinary telephone, might converse with friends who may be on a vessel several hundred miles at sea.

To this end the tests were made on the s.s. America, with General Electric Duplex telephone equipment.

The America is operated by the United States Lines and sails from New York to Plymouth, Cherbourg, and Bremen. The results of the tests are indicative of the future possibilities of radio telephony.

The Duplex apparatus has been used during two trips of the America, conversation from the ship being picked up at Deal Beach, New Jersey, U.S.A., and from thence, transmitted over the Western Electric Co's. line to a telephone switchboard at New York City, and by this arrangement conversation can be carried on from the vessel to any point in the American telephone system. Truly a radio triumph!

The input to the antenna on the America was approximately 750 watts. The Deal Beach station uses an antenna input of about 1500 watts. Duplex telephony has been carried on over a maximum distance of 1600 miles. This was the night range under good conditions. During the daytime reliable conversations were held at between 400 and 500 miles.

When it is desired to call a party on shore the ordinary telephone practice is followed. A regular desk telephone has been installed in Capt. Rind's quarters on the America. When he desires to talk to some one

Radio operator on board the S.S. "America" when 300 miles out from New York, arranging for a duplex telephone conversation between a passenger on the ship and members of the Radio Engineering Department of the General Electric Company at Schenectady, N.Y.

on shore he calls the ship's operator by pressing a button mounted on his desk. The operator answers, and after ascertaining the telephone number required, or the name of the party on shore, he establishes communication with Deal Beach, and the operator there switches in the New York telephone line, thus completing the circuit between the America and the switchboard operator at New York so that both operators can exchange information regarding the call.

When New York has the party ready to speak, the ship's operator calls Capt. Rind, and he converses from his extension in the same manner as over any telephone system.

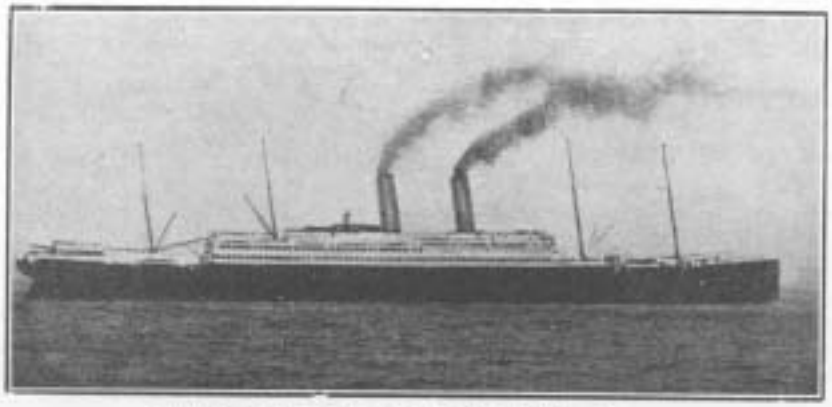
The equipment is not limited to a single extension on board the ship, as an extension may be installed in every stateroom if desired.

In the America's installation the radio transmitter is adjusted for transmission on a frequency of 800,000 cycles (375 metres).

Modulation, or speech control of the transmitter output takes place either at the operator's control unit or at the extension station. While conversations are being carried on, the transmitter oscillates continuously into the antenna system.

The duplex transmitter requires a direct-current supply at 10,000 volts for the plate circuit of the valves. This supply is obtained by means of the full-wave single-phase 500 cycle Kenotron rectifier unit. The plate and filament energy is supplied by a 500 cycle generator operating on the 125-volt direct-current ship mains.

Two Kenotron rectifiers, U.V. 218, are provided with spring suspension, and are mounted one above the other at the top of the transmitting panel.



The S.S. "America" of the United States Lines.

The motor-generator is started by pressing a push button in the operator's control unit. The Kenotron Valve filaments are supplied by a transformer at a potential of 11 volts; another transformer delivers a secondary voltage for the radiotron valve filaments at 11 volts. The plate transformer delivers a voltage of approximately 25,000 between outside terminals. The terminals of this transformer are connected to the plates of the Kenotron rectifier valves. This gives full wave rectification of the transformer output, producing a pulsating direct current, which is smoothed out by the filter condensers and filter reactor.

The panel provides for the generation and speech control of high-frequency energy over a frequency band of 1,000,000 to 375,000 cycles, corresponding to a wave-length range of from 300 to 800 metres. A six-position wave-change switch is mounted on the front of the panel, and a signal switch is placed close to the wave-changer so that telephony and continuous wave, or interrupted continuous wave telegraphy may be used if desired. The motor-driven chopper gives a 1000-cycle note when interrupted continuous wave telegraphy is being used. Two Radiostrons, U.V.-206, are mounted near the top of the panel; one operates as an oscillator, the other as a modulator.

Captain Rind at sea, speaking to New York.

We have become so accustomed to reading of wonderful developments in the domain of science that the significance of the success of the tests described in the foregoing article will not be fully appreciated without due consideration. Let the reader try to imagine what it will mean to have all ocean-going steamers fitted with duplex radio telephony apparatus similar to that installed on the s.s. America. Mid-ocean will have lost its isolation. Friends on shipboard will speak with friends on shore just as easily as one uses a trunk line on land to-day,—from his state-room the busy business man may direct his affairs on shore with the same facility as if in his own office.

An Anti-Body Capacity Receiver

OUR illustration shows the front view of an anti-body capacity receiver set which is being manufactured in Sydney, N.S.W. All the switches, condenser spindles, and the honeycomb coil adjusters, are connected by ebonite handles, five inches long, to eliminate body capacity effect. It is a splendid specimen of Australian workmanship.

On the left of the panel are the aerial and earth terminals.

Coupling adjustment is secured by gears made of ebonite. Between the primary and tickler coils are seen three studs and a switch. The first stud puts the primary condenser in shunt, the second stud is used when it is desired to use the primary condenser in series, and the third stud is a direct aerial to earth connection.

The first condenser below the honeycomb coil holders is the primary, the next one the secondary condenser. The two dials on the right, at the top of the panel, are for the grid and tickler circuits respectively. In all cases the dials are fixed, a pointer being screwed into the long handle, indicating the extent to which the condenser is switched in or out.

Front View of Anti-Capacity Receiver Set

The switch below the grid condenser is the filament on or off switch, and the one immediately below that is the switch controlling the rheostat. On the right of the valve is a switch for spark or arc-telephony reception. The remaining switch is for the "B" battery connections. There are eight studs for the "B" battery, one in the "off" position, the remainder providing for positive rises in the plate circuit current.

The panel is of ebonite and the surface has been matted with fine glasspaper to obviate leakage. The condensers are of low capacity, in order that the tuning may be thrown upon the inductances as much as possible, in accordance with good radio engineering practice.

The overall dimensions are 19 inches by 12 inches, by eight inches.

The two terminals on the right are for the phones, the three at the bottom are for the positive and negative of the "A" battery and potentiometer slider.

The Possibilities of the Future

IN fifty years' time, according to the great inventor, Thomas A. Edison, we must expect to see wonderful and startling advances in the way of communication, transportation, and living conditions. There is no limit to the possibilities of the radiophone development.

One has only to turn back to the files of an illustrated newspaper of 1872 to compare the marvellous age in which we now live with the relatively simple conditions under which people lived fifty years ago. To the present younger generation such things as telephones, motor-cars, aeroplanes, moving pictures, electric light, and wireless communication, have helped to bring more pleasure, convenience and education to all of us.

The phenomenal progress in invention shows that civilisation is on the right track, and that rapid strides will continue to be made.

Edison, writing in "Popular Science Monthly," states that the most minute sounds may be made audible by wireless across a continent. The dropping of a pin in New York may be heard as far away as San Francisco. It is difficult to imagine the practical possibilities of these developments.

Information, and entertainment, will be spread on a hitherto unparalleled scale.

Nearly every home in the land is being drawn into the wireless telephone's educational influence.

Edison is unable to foresee the wireless transmission of electric current for power purposes; neither is he able to agree with others who prophesy that power will be obtained by the liberation of atomic energy."

At the same time he is quite open-minded about such matters, and does not say that they are impossible.

He expects increasingly dramatic possibilities from the next few decades of science, owing to the numberless research specialists, some of whom may have startling surprises in store for us at any moment.

New brains will be required to push forward along these lines, to carry on the complicated processes of research, invention, and industry. The demand for brains will be sufficiently enormous to warrant a bigger proportion of young men entering the scientific and engineering professions than has ever been known before.

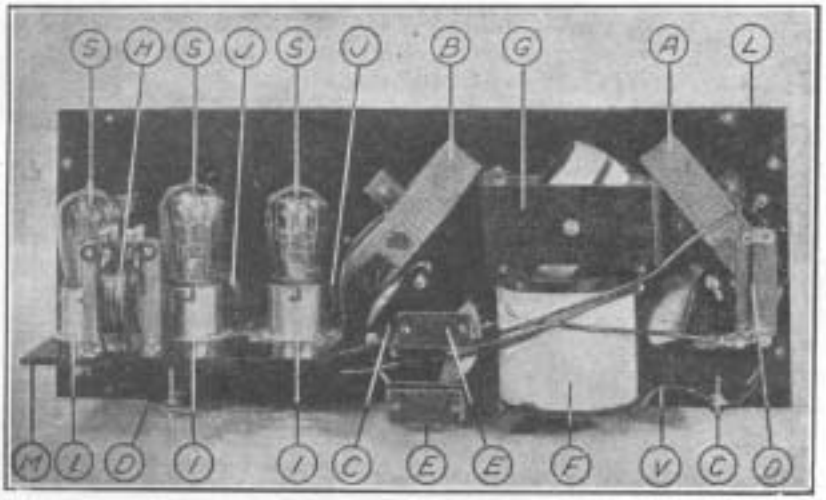
Great powers of imagination rightly developed must be possessed by research men.

"If you have real industry and ability, you are wanted at the top. The good ones are so rare! As the basis of all preparations for success in science and invention, take up physics. They and chemistry stand right at the bottom of everything."

Edison concludes his remarkable views by warning us that when we attempt to look into the future we must not forget that man himself has not changed for a thousand years, and although we may be happier, and more comfortable, we have the same defects and weaknesses as of old.

The Armstrong Super-Regenerative Circuit

MAJOR Edwin H. Armstrong, the inventor of the Super-Regenerative circuit, is attached to the Hartley Research Laboratory at the Columbia University, New York City, U.S.A., where he has studied under Professor Pupin. He estimates that the amount of amplification of the super-regenerative system is approximately 100,000 times as great as is possible with the ordinary regenerative circuit, and that it is probable that the ratio could be increased to 1,000,000 times. The new circuit makes possible this marvellous amplification by stopping oscillations of the regenerating valve and then carrying regeneration to the limit. It promises to revolutionize radio-telephony reception and offers a wonderful field for experiment to the radio enthusiast.

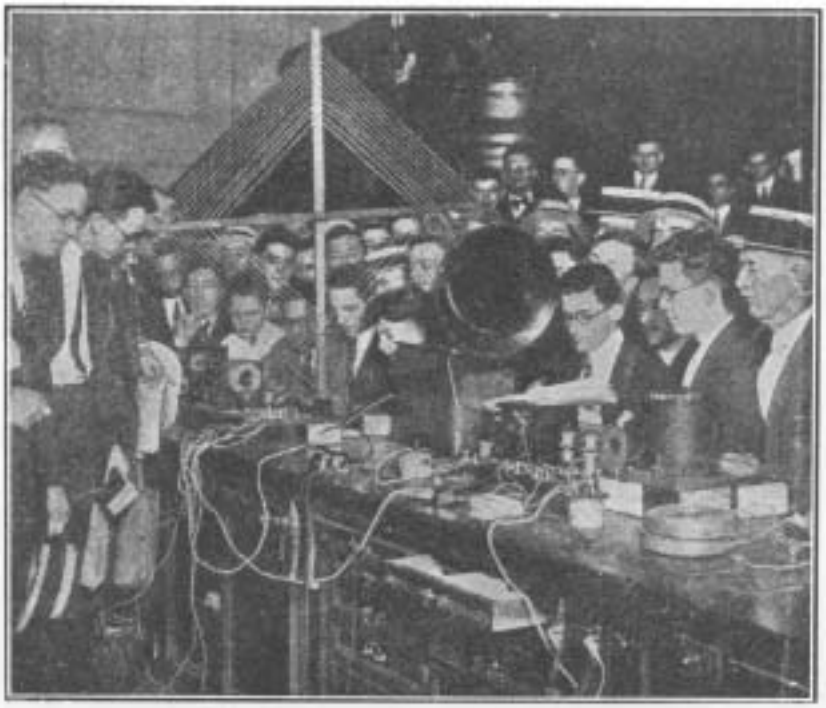


How to mount the instruments

Figure 1: The various items that are required in the assembling of this Armstrong-circuit set are illustrated in this diagram. Note that the coil F and the variometer G are placed in inductive relation to each other. The regeneration in the first tube circuit is controlled by the variometer.

In ordinary regeneration, if the plate circuit is coupled back to the grid circuit, the reinforced oscillations are fed back to the grid and are once more re-amplified by the valve. The amount of amplification is controlled by the coupling between the grid and plate circuits. The effect of regeneration is to reduce the effective radio-frequency resistance of the receiving circuit to a very low value, and we thus have a very powerful method of annulling the resistance of a receiving circuit. As the coupling is increased, the resistance of the circuit is lowered, with correspondingly increased amplification. When the resistance approaches zero, the valve commences to oscillate, and the speech or music becomes lost in a chaos of noise. In his super-regenerative circuit, Major Armstrong increases the coupling until the valve is far beyond the oscillating point, the effective resistance of the circuit is brought to less than zero, and it is made to have a negative resistance. He discovered that he could stop oscillations in a negative resistance circuit by introducing resistance in the circuit at definite intervals, or by reducing the amount of regeneration, so that the circuit resistance becomes positive and negative alternately. In both cases the effect is to give the circuit first a positive and then a negative resistance. This alternation is sufficient to prevent oscillations. The alternation is brought about by using one valve as an oscillator at a frequency of from 10,000 to 15,000 cycles.

Just as the regenerative valve is ready to burst into oscillations of the circuit frequency, the applied frequency reduces the plate voltage to a low value, thus reducing regeneration and introducing a positive resistance in the grid circuit, effectively cutting off any sign of free oscillation.



This set amplifies from 100,000 to 1,000,000 times

When E. H. Armstrong demonstrated to the public his remarkable super-regenerative receiver at Columbia University he remarked: "The super-heterodyne circuit is still the Rolls-Royce method of getting practically unlimited amplification. But there are some people who prefer to use Fords. This super-regenerative circuit is the Ford method of amplification." This picture shows some of the radio fans, young and old, who grouped about the set—following the demonstration of its capacities

The remarkable feature of the Armstrong circuit is that it permits practically unlimited amplification, but only requires a small number of valves. In the first demonstration, only one, two, and three valves were used.

A mass of information has come to hand regarding the super-regenerative receiver, many of the circuits requiring apparatus not readily obtainable in Australasia.

The average experimenter requires a circuit which includes apparatus readily obtainable, and which at the same time is effective, flexible, and simple in operation.

Our diagram, figure 2, shows the connecting up of a set which will fulfil the above conditions, the letters that designate the various parts corresponding with the photographic illustrations and the list of apparatus.

For building the set the following materials will be required:—

1 ebonite tube 4 inches long, 3 inches in diameter, wound with 60 turns of No. 18 S.C.C. copper wire. F.
1 duo-lateral or honeycomb coil of 1250 turns A.
1 duo-lateral or honeycomb coil of 1500 turns. B.
1 duo-lateral or honeycomb coil of 200 turns. Q.
2 variable condensers .001 Mfds. capacity C.
2 fixed mica condensers .002 Mfds. capacity D.
2 fixed mica condensers .0005 Mfds. capacity E.
1 moulded variometer G.
1 amplifying transformer H.
3 valve sockets I.
3 filament rheostats J.
10 terminals K.
1 insulating panel, 8 inches by 20 inches, by ¼ inch. L.
1 insulating panel of suitable size for mounting valve sockets and the amplifying transformer. M.
3 large knobs and dials. N.
1 cabinet, outside dimensions 8 inches by 20 inches, by 6½ inches, with a door at right top 4 inches by 8 inches for inserting the valves O.
2 automatic lighting jacks, one double circuit, and one single circuit. P.
1-1 megohm grid leak R.
3 Radiotron U.V. 201 valves S.
Miscellaneous screws and bolts T.
Bare copper connecting wire U.
Insulating tubing for covering connecting wires V.

The method of mounting the various parts is shown in photo figure 1. The diagram, figure 3, gives the wiring up.

The 200 turn duo-lateral or honeycomb coil cannot be seen in the illustration figure 1, but it is mounted flat against the panel at the back of coil F.

The 1250 and 1500 turn coils are fixed in the position shown in the photograph. Two of the knobs and dials are used on the condensers and the remaining one on the variometer.

Coil F and variometer G are placed in inductive relation to each other.

Two terminals are placed on the extreme left of panel for coupling in the loop aerial. Two on the right for phones or loud speaker. Starting from about the centre of panel, and near the bottom, six terminals are placed in position. Counting from left of row, the first terminal is for the negative of "A" Battery; second, positive of "A" Battery and negative of "B" Battery; third, "B" Battery positive, of the first two valves; fourth, "B" Battery positive of the third valve; fifth, positive "C" Battery for second valve grid; sixth, negative "C" Battery for second valve grid. Reference to the diagram will show how the "C" Battery is coupled in—the negative to the grid of the second valve, the positive to one lead of the 1250 turn coil.

The loop aerial is to be made up with No. 18 S.C.C. copper wire, on a three-foot square wooden frame and wound spirally. Number of turns, 12 or more, according to wave length to be covered.

A 6 volt "A" battery will do, but an 8 volt one is better; and a "B" battery of 100 volts on the first two valves, and 150 volts on the third. The "C" battery on the second valve to be about 3 volts. (Note that

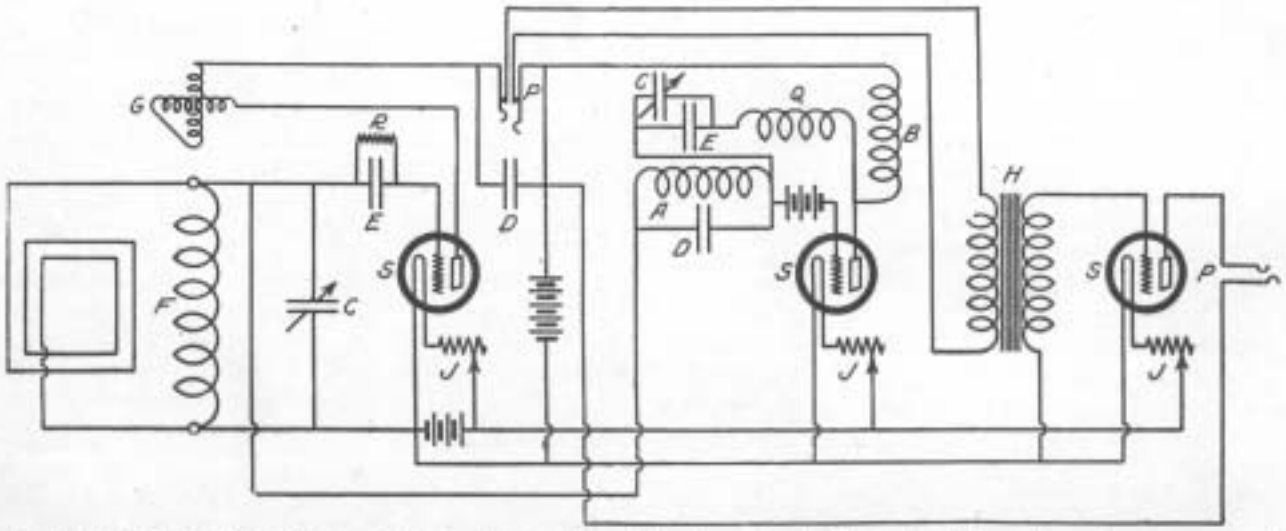


Figure 2: This diagram shows the circuit for the receiving set described in this article. The letters that designate the various parts correspond exactly in the diagram, the text and in the photographic illustrations, so the confusion in wiring may be avoided.

the Ever Ready Company are putting up a 12 volt "C" battery rising in 1½ volt steps). The "C" battery on the second valve is used to keep the grid at the correct negative potential.

The condenser across the primary of the amplifying transformer will be found to be quite effective in preventing "knocking" of the amplifier valve and no other form of filter is required in the circuit.

To tune, turn up the filaments rather high and then set condenser "C", on left of diagram, at zero.

Next, turn the other condenser to nearly maximum. The variometer knob should then be turned until a loud squawk is heard. Now turn down the filament of the second valve until the squawk increases in intensity. The squawk is next tuned out by adjusting the variometer. For each given setting of the wave-length tuning condenser, there is a setting of the variometer at which signals will come in loudly. If the signals are not clear, both condensers should be adjusted and the filaments of all three valves should be varied, and this process should be followed out until the signals are free from distortion. The usual precautions as to soldering joints, etc., should be carefully followed, and both "A" and "B" batteries should be tested to ensure that they are in good working condition.

Major Armstrong's discovery of the super-regenerative circuit is probably the most wonderful event in the history of radio science, and in the practical, efficient and yet simple super-regenerative set described herein, both individual experimenters and radio clubs, will have the means of demonstrating to the general public, what the latest invention in radio science means for the service of mankind.

If coil "F" is tapped at 20, 30, 40 and 45 turns it is a help in tuning. The aerial may be clipped on the loop if it is desired to test on an outside aerial, but no earth connection should be used.

Honeycomb Coils

THE honeycomb coil marks a distinct advance in the design of tuning inductances. It is exceedingly compact and portable, and the losses are lower than in any other type, as the manner in which it is wound reduces the distributed capacitance to a minimum. No other kind of inductance will cover the whole range of wave lengths so effectively. Some experimenters still adhere to the opinion that the vario-coupler, variometer style of inductance is best for short wave-lengths, say from 200 to 500 or 600 metres, but, taken all round, the honeycomb coil has its advantages for short as well as long wave-lengths.

The usual regenerative circuit has three honeycomb coils, primary, secondary and tickler, and they are mounted in that order on a stand or panel mounting, which permits the primary and tickler to swing away from the secondary to a maximum of a 45 degrees angle. They can also be used in a two-coil circuit, or as variometers, and as choke coils.

From the table given below the amateur can select coils suitable for the wave lengths which he desires to cover.

For best results the tickler coil should have from 35 per cent to 75 per cent. of the inductance of the secondary coil. The primary and secondary coils may have the same number of turns, but the condenser in the primary circuit should be furnished with a switch to place it either in series or shunt in order that the wave-length may be lowered if necessary.

In last month's Review, particulars were given of a simple method of winding honeycomb coils. The size of wire used may vary from 24 gauge S.C.C. copper wire to 32 S.S.C. wire. Coils of from 25 turns to 150 turns No. 24 wire is suitable. From 200 to 500, No. 25 wire, and from 600 to 1500 turns, No. 28 or No. 32. Many prefer to use cotton covered wire for all sizes of coils.

In the following table, with an average aerial, the wave-length of the various coils is based on the assumption that the condenser in the primary circuit will be one of .001 mfds capacity, and that of the secondary circuit .0005 mfds.

SIZES OF COILS AND WAVE-LENGTHS.

No. of turns	Millihenries inductance	Wave-lengths in metres
25	.040	170-375
35	.075	200-515
50	.15	240-730
75	.3	330-1030
100	.6	450-1460
150	1.3	660-2200
200	2.3	860-2850
250	4.5	1120-4000
300	6.5	1340-4800
400	11.	1860-6300
500	20.	2340-8500
600	40.	2940-12000
750	65.	3100-15000
1000	100.	5700-19000
1250	125.	5900-21000
1500	175.	7200-25000

COMBINATIONS OF COILS FOR VARIOUS WAVE-LENGTHS.

Wave lengths.	Number of turns of coils for— Primary.	Secondary.	Tickler.
140-240	25	25	25
550-700	75	100	50 or 75
900-1400	150	150	75 or 100
1650-2750	300	300	150
3000-15000	600	750	300-400 or 500
19000-20000	1000	1250	500-600 or 800
18000-25000	1250	1500	600-750 or 900

An alternative table of coil combinations is as follows:—

Wave Lengths.	Number of turns of coils for:— Primary.	Secondary.	Tickler.
145-350	35	25	35
305-710	75	50	35
635-1660	150	100	75
854-1970	200	150	100
1420-2850	300	250	150
2550-4250	500	300	200
4200-6300	500	400	200
6250-14500	1250	1000	400
13600-21000	1500	1250	500

From the above particulars the experimenter may devise numerous circuits for either the two-coil or three-coil mounting.

Wireless Pars from Everywhere

'TIS CORRECT ENGLISH.

A LONDON literary weekly says "broadcasting" is a new word added to the language by wireless telephony. Such a periodical should rather have referred with pleasure to the fact that the good English verb "to broadcast" has found apt employment for many years.

There is a popular hymn which thousands of Lancashire people sing at Whitsuntide, whose first verse begins, "Sow in the morn thy seed," and ends with "Broadcast it o'er the land." Reference to the Thesaurus confirms the fact that "broadcast" was already in the language, and suggests that in its place we might easily have been afflicted with one of its synonyms. "Widespreading" would have been as good, but neither "divaricating," "difusing," "dispersing," nor "disseminating" would have hit the mark so truly.

* * *

POLAND INTERESTED IN RADIO.

THE Polish Minister of Communications is going to the United States to study the wireless system. His investigations will form the basis for the operation of the great station being erected at Warsaw, and also for the future Polish radio telephone broadcasting activity.

* * *

POLICE TESTS IN CHICAGO.

EXPERIMENTS in the use of radio in the transmission of police messages in Chicago have proved a complete success, George B. Carlson, Commissioner of Electricity, says in requesting an appropriation of sixty-eight thousand dollars for radio equipment and personnel.

If granted the appropriation a new duplicate sending station will be installed on top of the City Hall. The eight high-powered bandit cars used by the Detective Bureau will be equipped with both sending and receiving sets.

"I think the equipment of the bureau cars with radio sets will prove an important factor in arresting criminals," Chief Fitzmorris said. "I doubt whether radio development is sufficient to warrant its use by ordinary patrolmen, however."

RADIO CIRCLES GLOBE.

RADIO time signals sent out from the Annapolis Station have been heard at the Antipodes, or half-way around the world. According to C. E. Adams, official astronomer and seismologist at the Hector Observatory, Wellington, New Zealand, time signals sent by the radio from the Naval Station at Annapolis, Md., were heard distinctly by him. Another report received by the Naval Observatory from Australia stated that the time signals had been heard there within a fraction of a second after their transmission, apparently coming both ways around the world.

* * *

TORONTO PAPER OPENS STATION.

THE "DAILY STAR," of Toronto, which has been using the radio telephone transmitter of the Canadian Telephone Co. for broadcasting purposes, now has its own station, CFCA, and is broadcasting nightly programmes at 7 p.m. on 400 metres. The station has been heard at a distance of from 500 to 700 miles, using six amperes in the antenna. The set uses four 500-watt oscillator tubes and a 250-watt tube as a modulator. The antenna is of the T-type, 200 feet long, supported on 80-foot steel towers, on the roof of the "Star" building.

* * *

RADIO POPULAR IN PARIS.

WIRELESS telephone concerts are gaining popularity in Paris, and the big department stores are offering this entertainment daily to their clientele. From the top department of the Louvre, or the furniture section of the Printemps, the visitors can hear, about six o'clock, concerts given at the central wireless telephone station of the Eiffel Tower.

One of the popular-priced stores, the Palais de la Nouveaute, uses it as an advertising means, and has installed in the main hall of the store a huge horn with a very powerful receiving station, so that all the visitors in the hall can hear the concert and other communications as well.

TO HELP PASS TIME.

ANOTHER new use for radio has been discovered by an enterprising theatrical manager in Los Angeles.

The New Mission is the first Los Angeles theatre to use the radio service, or any radio, as a means of entertaining patrons waiting in the lobbies for admission to theatre auditoriums.

The patrons were delighted with the innovation, and they found waiting in the lobby such an entertaining part of the show that the management intends to give the radio concerts from the stage.

* * *

RADIOPHONES FOR ALASKA.

WITH the co-operation of the navy, radio telephones have recently been installed at several of the remote lighthouses in Alaska.

Some of the lightships are also equipped as radio fog-signal stations, with the new department of commerce system, used continuously during foggy weather to furnish accurate bearings to ships possessing the radio compass.

According to George R. Putnam, commissioner of lighthouses, radio should be a great boon in relieving the lonely and monotonous life of the faithful keepers at isolated stations both on lightships and at lighthouses. The keepers of the Alaska lighthouses at the entrance to Bering Sea remain at their posts for three years on a stretch; they have been without mail for ten months. At Tillamook Rock Light, off the Pacific coast, bad weather has prevented direct communication with the shore for periods of seven weeks at a time. On the offshore lightships supplies are received usually only once a month, and the tenders often work in remote localities.

* * *

RADIO TO AID BABIES.

JUDGE GUSTAVE HARTMAN, of New York City, who is president of the Israel Orphan Asylum, made a radio appeal recently from WJZ for funds to rebuild a home for 200 orphan babies, made homeless by the recent disastrous Arverne fire.

NEW CANADIAN STATION.

LA PRESSE, of Montreal, Canada, has signed a contract with the Canadian Marconi Company for the immediate installation of a radio broadcasting station. At stated hours each day, starting early in June, it will broadcast in French and English condensed bulletins of the most interesting news of the day, as well as attractive excerpts from the feature pages of the paper.

RADIO AIDS HOME MAKERS.

JUST as newspapers contain departments for women, so have the radio telephone broadcast programmes been giving time to subjects of home interest, such as dressmaking, cleaning, cooking, and all the thousand and one problems facing the housewives of America. Competent speakers on domestic subjects appear from time to time on the programmes.

WILL LISTEN FOR SPIRIT WAVES.

SIR ARTHUR CONAN DOYLE, who recently went to America to lecture on his psychic investigations, has become a radio fan, and will take back with him to England a complete wireless outfit of American make. He states that though so far he knows nothing of radio, he feels sure that it will give him a deeper insight into the psychic world.

Sydney Technical High School Radio Club

NAVY STUDIES STATIC.

THE U.S. Navy this summer is making a special study of static in order to determine more facts as to its cause and methods of overcoming it. All the Navy Radio Compass stations are co-operating with the Weather Bureau in making observations as to the locations of static disturbances, in order to discover whether there is any connection between storm centres and static centres. Three static compass bearing observations are taken daily during the progress of the work.

CHINESE WIRELESS.

ANNOUNCEMENTS have appeared in the Peking, China, "Leader," stating that the Government wireless station at the Temple of Heaven, Peking, is open for service, and that all telegraph offices in the city will accept radiotelegrams at the same rates as those charged for land-line messages for transmission to Kalgan, Wuchang, Woosung, Shanghai, and Foochow. Special rates apply to radiotelegrams sent to ship and aviation stations, and such messages are accepted only by the central office.

"RADIO, PAGE MR. BROWN!"

RADIO amplifying equipment, such as is used in many amateur receiving sets, is being used by the Hotel Essex, Boston, Mass., to replace the time-honoured paging system. When requested to "page Mr. Brown" the telephone operator merely turns to a paging transmitter at her elbow and says, "Mr. Brown, please, Misterrr Brrownn." And Mr. Brown, if he is in the lobby, hears the call from loud speakers located at suitable points.

How To Begin: By an Amateur for Amateurs

Article 1

THE Editor says that the best man to teach the toddling baby steps of radio is one who has just come through the "crawling" stage himself.

I am certainly a baby radio fan, as it is less than six months ago that I decided to dabble in the mystic science. I do not feel very competent to "teach" others, but perhaps if I set down my own experiences it will serve the Editor's purpose, and, at the same time, be helpful to my fellow experimenters.

Some time ago I heard a friend describing the transmission of sound. He pointed out that there was no such thing as "sound"—really, that a person speaking, or a brass band playing, did not make the slightest "noise," and that all they did was to set up "vibrations," which travelled through the air to our ears; that the ear drum received the vibrations and communicated them to the brain cells, where the sensation we call "sound" is set up. He illustrated this by having two tuning forks of the same pitch. One was stood upright in a little stand, and he went off some feet and struck the other. The tuning fork in the stand immediately commenced to vibrate, in unison or sympathy with the first tuning fork. It is rather hard to grasp, at first, that all the blare of a big brass band is created within our own heads by nature's receiving apparatus, but it is a fact, nevertheless. The demonstrations with the tuning forks convinced me that sound produced vibrations of the air, and that these vibrations travelled from the source of the vibrations in every direction. During the course of his remarks, my friend went on to say that the drum of the ear might be compared with the phonograph speaker, or that part of it termed the diaphragm, the thin, circular piece of glass or mica to which the needle attachment is cemented. Asked how it was that the phonograph diaphragm could give out all kinds of sound, he said that a piano string, tuned to give out the note "C," for instance, when struck by the little hammer, vibrated over the whole of its length, the vibrations being very wide at the centre of the string at the moment of being struck, and then gradually dying away from each end until, finally, a very small length of the wire in the middle moved to and fro with invisible vibrations, at length coming to complete rest. During the time the piano wire was vibrating, first over the whole length, and then gradually diminishing by infinitesimal degrees until the state of complete rest obtained, it gave out "sounds" which traversed the whole system of harmonics.

Big vibrations gave out a big "sound," tiny ones tiny "sounds."

This made it easy for me to understand that a phonograph diaphragm acted in the same way.

Later on, when I started in wireless by reading up the subject, I remembered the piano string illustration, and it enabled me to understand how a transmitting source sets up vibrations in the ether and how the telephone diaphragm, at the receiving end, reproduced those vibrations, which the ears converted into "sound."

I learned that sound vibrations travelled through the air at a thousand or so feet per second, whereas wireless vibrations traversed the ether at 186,000 MILES per second!

This recalls a funny little incident. I was tapping a key in circuit with a spark coil and gap, and a little friend, some seven years old, was looking on in awe and wonderment. I told him that the spark could go round the world several times in one second. He answered, "Well, let me see you do it!"

The average beginner in wireless does not concern himself with transmission, but wants to "hear something." In my reading of the literature I concentrated my attention on receiving apparatus.

I found that vibrations go out in wave lengths, the higher the sound the shorter the wave length, the deeper the sound the longer the wave length. We can confirm this by referring again to the piano. The shrill treble notes are given out by short tightly strung wires, the deep bass notes by long wires not so tightly strung. In a piano, a string is "tuned" by tightening or slackening it until just the right sound is given forth; in other words, the string is allowed to vibrate faster or slower, according to what is required. Another illustration is furnished by tying a weight on the end of a string, and then setting it oscillating or moving to and fro.

If the string is long the oscillations will be slow; if short, there will be short, quick movements.

In wireless, the vibrations from the transmitting source are tuned in much the same manner in which the piano string is tuned. Certain features of the transmitting apparatus permit of the vibrations being sent forth at a certain rate per second, this constituting the "wave length," all vibrations moving in waves of definite length, or frequency, per second. In the tuning fork experiment, the second fork vibrated in unison with the first one because it was of the same pitch or tone; a fork of another tone or pitch would not respond. In receiving wireless waves the receiving apparatus must be capable of being tuned to the same frequency or wave length as that used in the transmitting source.

Having assimilated the foregoing, I turned my attention to the apparatus necessary to "tune" wireless waves, and to the means of hearing the vibrations set up by the waves.

I ascertained that wires hung up in a certain way, called an "aerial," intercepted the waves, and that the tuning was done by a coil of wire termed an "inductance" or receiving transformer, or by an inductance combined with another piece of apparatus known as a "capacity" or condenser. I found that I could do without a condenser for a start, so decided to enquire into "inductances."

(To be continued)

How Broadcasting is Done

THE accompanying photograph is of the interior of a present day broadcasting studio. The stand in the foreground is the support for the microphone, through which the singer's voice will be transmitted to the electrical apparatus where it is first amplified and then sent out from the aerial to be heard by "listeners in" up to 4000 miles away.

A Professional Broadcasting Studio

The observer will be struck by the absence of complicated radio apparatus. Experience has taught broadcasters that the room in which the singing or playing is done must as nearly as possible approximate, in its conditions, the ordinary drawing room, and that it is better to have a separate room for the transmitting apparatus. If the room is too well filled with furniture, there is a confusion of sounds. On the other hand, if it is too empty, there is a hollowness and echo.

To guard against the latter, the walls of the studio are hung with heavy draperies, a procedure which has been found to overcome even the slightest suspicion of reverberation, and which the super-sensitive microphone would readily pick up.

In the early days of broadcasting, phonograph records were used, but as time went on, it was thought that radio-enthusiasts would like to hear singers and musicians. These concerts soon become very popular, and now the best of artists, singers, musicians, and comedians, are heard by many thousands, per media of the radio receiving set.

We have, in New South Wales, a State Orchestra, one of the best in the world. At present it can only be enjoyed by a limited number of people at one time. By a little initiative and energy, State Orchestra concerts might be heard by people all over the State, and, with a sufficiently powerful transmitting set, all over Australia. Some enterprising firm should take the matter up and make the Orchestra in fact, as well as in name, a State Orchestra.

There should be no difficulty in obtaining permission from the Government to erect an aerial on top of the Conservatorium—and with the necessary microphones and sound collectors unobtrusively placed around the stage, the transmission of the State Orchestra concerts would be a comparatively simple matter.

The second photo illustrates how transmitting is done in the home of an amateur broadcaster. The two lady singers are being heard over a radius of 500 to 600 miles.

How an Amateur Broadcasts

A Simple Tuner

THE simplest form of tuner may be made with what is known as "spider web" coils. Procure two six-inches square pieces of 1/16in. Bakelite, draw a diagonal line from each corner, to give you the exact centre—describe a circle 5¼ inches in

Fig. 1

diameter, and another one of 1¾ inches. Cut round the outer circle. Mark off eleven equal spaces, which will be 1½ inches centre to centre of slots to be mentioned presently, on the outer circle and a similar number of spaces on the inner circle which will be half an inch centre to centre. Run a line from outer circle to inner circle marks and on each side of this line run another 1/16 inch from the spacing line, and cut from outer to inner circle, a slot which will be 1/8 inch wide. You will now have a circular former with eleven 1/8 inch slots. The wire re-

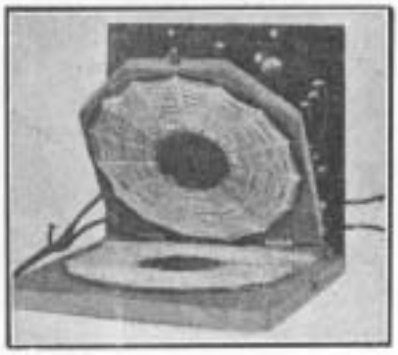


Fig. 2

quired will be No. 25, 26, or 27, and single cotton covered will serve. About 400 feet of wire will be required for the coils and necessary taps. Four ounces of No. 27, five ounces of No. 26, and six ounces of No. 25 will contain the 400 feet of wire. Bore a 1/8 inch hole in the centre of each Bakelite disc, mount a terminal with an eighth-inch stem or less on a piece of board; put two small washers on the terminal, then the Bakelite disc, and, lastly place two washers on top of the disc and screw the terminal head on, but not too tightly. Wind your wire on a reel and drive a nail through a piece of board to hold the reel whilst the winding of the coils is being done. The terminal arrangement will allow you to turn the disc during the process of winding. Leave about ten inches of wire free and then commence winding at the bottom of the slots, to the left of one slot, to the right of the next, and so on. Don't

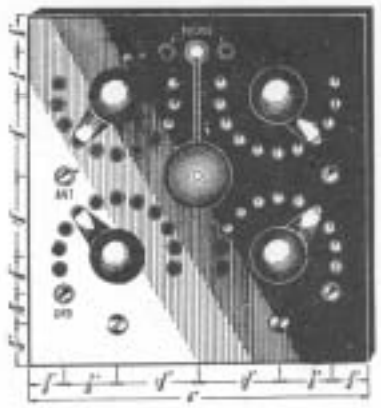


Fig. 3

pull too hard on the wire but see that it sits closely round each slot. Continue the winding until you have wound on 120 circles, each circle being completed, of course, each time the wire comes opposite the starting point. As you progress you will make provision for the taps. Before starting, mark off your wire in black ink, in several ten-inch lengths. The first ten inches is for the free end at the beginning. Wind on when you come to the first mark, bring the second mark to it, forming a loop, bare the wire for half an inch up from the marks towards the bow of the loop, twist neatly, ready for soldering and proceed with the winding.

If a small piece of card is attached to each tap as it is made, numbered one to ten, it will be a help, when it comes to soldering up. Do not allow two taps to come upon the same spoke, as it is better to lose or gain an inch or so. These units taps will take up sixteen circle turns, and the

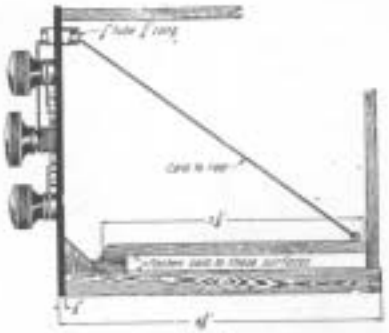


Fig. 4

next lot, the tens taps, should be started on the twentieth circle. For the tens taps, 100 inches of wire is measured off and marked, and when the mark is reached, the loop is twisted and formed as for the units, a ten-inch length being allowed for each tap as before. Each 100 inches of wire will bring the taps on circle turns Nos. 34, 47, 59, 70, 80, 89, 97½, 113, and 120. The tens taps should also be marked one to ten with pieces of card. Wind one disc clockwise and the other counter-

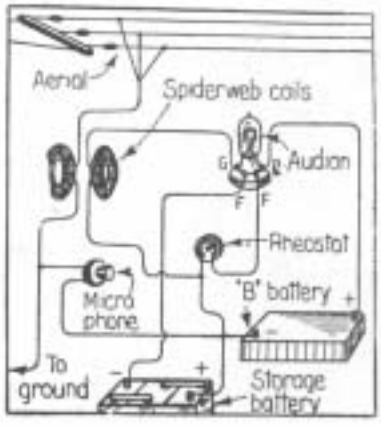


Fig. 6

clockwise, so that the windings will run in the same direction when the two discs are placed face to face, that is, with the taps on the opposite

sides. When the winding is complete, cut one side of the loops close to the twisted part, and you have a ten-inch length ready to be joined to the studs of the panel. Touch the twist with a soldering iron, using resin for a flux, and the tap is complete.

The coils are mounted on two pieces of thin wood, six inches square and hinged together. Rule two diagonal lines across each piece of board to strike the centres, and bore a hole ¾ inch diameter to draw the tap wires through. A six-inch square piece of eighth or quarter Bakelite forms the panel. The panel is screwed to a box of ¾ inch wood, the box being 6 5/8 inches deep overall.

Eleven studs are required for each set of tens and units taps, two sets of eleven at the top for the moving coil and two sets at the bottom of the panel for the fixed coil. The fixed coil lies on the bottom of the box, and the moving coil is attached to the hinged piece of wood. At the top centre of panel, a hole is bored, through which a cord is run to lift the moving coil from the fixed one. A knob with half an inch of brass spindle may be used to wind the cord on. The hinge is placed next the panel, the cord is attached to the end opposite the hinge by a small picture frame eyelet. The coils are attached to their boards by small tacks.

The board of the fixed coil is attached to the bottom of the box, by tacks or small screws. An angle of about 45 degrees is about the maximum distance the moving coil will be raised from the fixed one.

Four rotary switch arms and knobs and six terminals will be required. Two terminals are for the phones, two for the aerial and earth connections of the fixed coil, and two for the secondary or moving coil circuit.

No condenser is required in either circuit as the units and tens tappings provide sufficiently fine tuning to render condensers unnecessary.

Figure 1 gives a view of the back of the panel with the moving coil close coupled; figure 2 shows the moving coil raised to maximum position. Figure 3 is the front of the panel, and figure 4 a side view of the tuner.

The wave-length range is up to 500 metres but by making similar coils without taps, placing them underneath the tapped primary coil with about half an inch separation, these loading coils, connected in series with the primary coil and aerial, will cover any wave-length required. If loading coils are desired, it would be advisable to make the panel slightly larger and provide a rotary switch arm and studs for cutting in or out the loading coils.

Figure 5 shows an alternative method of using the spider web coils.

In this case they are wound on old five inch records, only eight slots being employed. No. 1 record is the primary and is wound with 49 turns, a tap being taken off at every seventh turn. Record No. 2 is the primary loader and has 125 turns, no taps. Record No. 3 serves as a secondary and is wound with 75 turns, no taps.

Another record is used for the rotary switch arm and studs, and the various connections and a fifth one is used to back the whole receiver.

The tuner first described is a much better one and may be used with a crystal detector or with a valve.

Figure 6 shows the spider web coil adapted to a transmitting set. Each coil has 30 feet of No. 26 S.C.C. wire, and an amplifying valve is used, with 130 volts on the plate; a five watt power valve may be employed with 200 to 300 volts on the plate.

With an amplifying valve this set has a range of 15 miles with perfect modulation and a very sharp wave.

Spider web coils may also be used as variometers, and are very compact and efficient. As variometers they are wound on the "figure 8" coil plan.

The tuner can be made for a few shillings, and experimenters who have made up spider web coils claim that they are better than many other forms of inductance.

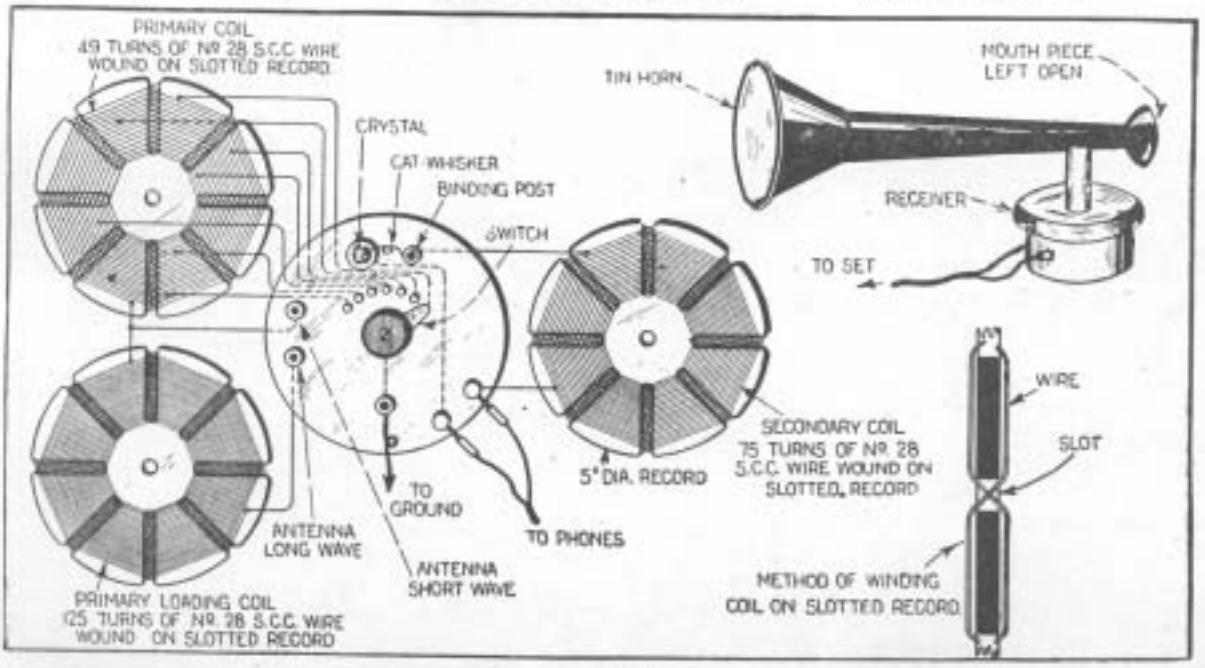


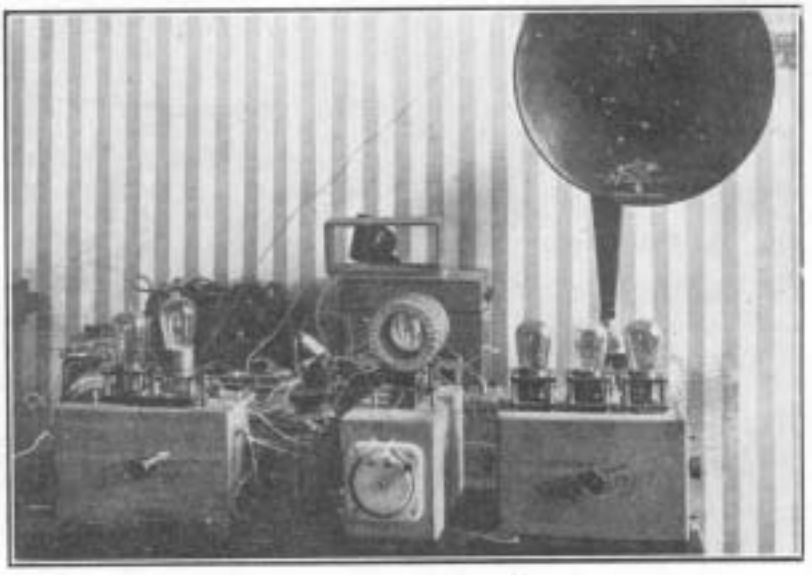
Fig. 5

A Cigar Box Receiving Set

By "Experimenter"

IN using a set of table instruments some means of coupling the different parts together must be devised, and it occurred to the writer that the humble cigar box might very effectively perform the function. A photo of the cigar box set accompanies this article. The box on the left has four terminals on each end: on one end there is a rheostat knob, and there is another on the front of the box. The two valves are two stages of radio-frequency, one stage having a Radio Corporation UV1714 transformer, and the other stage is inductively coupled.

On the left of the box, and not seen in the picture, are two potentiometers, both coupled in parallel to the positive and negative of the "A" battery, the slider of the first potentiometer being coupled to the negative of the "B" battery, and the other slider is connected to one side of the secondary of the radio-frequency transformer and then away to earth. Of the four terminals on that end of the first box, the two lower ones are attached to the positive and negative of the "A" battery, and the two upper ones to the two sliders of the potentiometers. Each valve has its own rheostat. The two lower terminals on the right end of the box are for the positive and negative of the "B" battery and right upper terminal is attached, inside the box, to the secondary of the transformer, and then, from the outside, to the grid condenser and grid leak. The other terminal is connected to the "B" battery. The middle cigar box has a rheostat on one end for the detector valve, and there are two terminals at the top, at the other end. One of these terminals carries the lead from the tickler circuit condenser (.001 variable) then on to the amplifier. The other terminal has the lead from the "B" battery and from there another wire is taken across to the amplifier. The two terminals mentioned are where the phones would be attached if no amplifier were used. The box on the right of the photo is a three-stage amplifier. There are four terminals on each end, and a rheostat knob, and there is another in the centre front, thus providing a separate rheostat for each audio-frequency valve. The first audio-frequency transformer is an "Acme," the second a "Homecraft," and the last one a "Federal." On the table is a bank of "B" batteries—three forty volt, one thirty, and one twenty, the latter having 1½ volt steps. The Radiotron UV200 detector valve is supplied with 10 volts, to 45 or 50 volts, according to the circuit being tried out, the one-and-a-half volt steps of the twenty volt battery being very useful for critical experiments. The first audio-frequency transformer receives the same plate voltage as that impressed on the plate of the detector. The second one has its own "B" battery terminal, tie-clip connectors, allowing any voltage from 10 to 170 to be coupled in. About 80 volts are used on the second transformer as a rule. On the last stage of the amplifier, anything from 80 to 170 volts is used. The usual "A" battery negative lead to one side of the secondaries of the audio-frequency transformers, is first coupled to the positive of a 12 volts "C" battery, which has 1½ volt steps. The negative of this battery is then carried to the terminal connecting with the transformer secondaries, thus biassing the grids of all the amplifier valves and tending to keep them at the proper negative potential. A tie-clip connector allows of the "C" battery being varied from 1½ to 12 volts, the voltage applied being ruled by what is necessary to eliminate "the canaries." By adjusting the potentiometers, the .0005 grid condenser, and the "C" battery, all trace of whistle, squeal, or howl, is entirely done away with. There is no shielding in the amplifier, the adjustments mentioned being all that is necessary to banish undue noises. The four terminals on the left of the amplifier are used as follows: the two lower ones for the negative and positive of the "A" battery, and the two upper for the connections from the detector. A one megohm grid leak is connected across the upper and lower right hand terminals, that is across the plate circuit terminal of the first stage of the amplifier and the positive of the "A" battery, and the left hand upper and lower have a .001 fixed condenser across them. The secondary terminals of the first audio-frequency transformer are connected by a static leak, consisting of



The Cigar Box Receiving Set

a .002 fixed condenser and a two megohm grid leak. A .002 fixed condenser is placed across the phone terminals of the detector unit, in the ordinary way. The two upper terminals on the right of the amplifier are connected—one to the plate of the last amplifying valve and then on to the loud speaker, the other, to the "B" battery, then away to the loud speaker also, and inside the box, this terminal is connected to the primary terminal of the last transformer only.

The right hand side lower terminal carries the "C" battery bias to all three secondaries, of the transformers, the left lower terminal is coupled to the "B" battery, and this terminal and the left hand upper terminal are connected.

At the potentiometer end there is a .002 fixed condenser between the slider of the first potentiometer and the negative of the "A" battery, to by-pass the radio-frequency current.

At the moment of writing, the inductive coupling of the second stage of the radio-frequency unit has been done away with and the two valves are coupled in parallel—that is, both plates to the same primary terminal of the radio-frequency transformer, with two leads to the grids from the same terminal of the condenser (.001 variable) in the secondary circuit of the honeycomb coil inductance. Probably there is not much gained by so paralleling the two radio-frequency valves, but there is a decided difference in the result attained if the two filaments are varied when signals are coming in.

At the back of the picture of the set will be seen the "A" battery, a Star, and to the right of the battery is a Tungar rectifier. On the top of the Tungar is a three-plate micrometer condenser which is shunted round the secondary condenser.

The circuit may seem a little complicated, but the result is clear, ringing signals, and perfect voice and music reception, and as for static—well, none has been heard since connecting up the set in its present form.

The inductive coupling of the second stage of radio-frequency perhaps gives a little better result than the paralleling described, and a further test will be made to settle this point. Two 200-turn honeycomb coils were used for the inductive coupling, the coil in the plate circuit of the second stage of radio-frequency being shunted by a .0005 variable condenser. This coil was connected across the plate and the "B" battery. The other coil was connected across the grid of the detector and the negative line of the "A" battery. Forty to eighty volts "B" battery potential is impressed on the plates of the radio-frequency valves. The amplifying valves are UV.201 radiotrons and Cunningham amplifiers.

A "stand" pattern of honeycomb coil holder permits experiments with all wave lengths to be carried out.

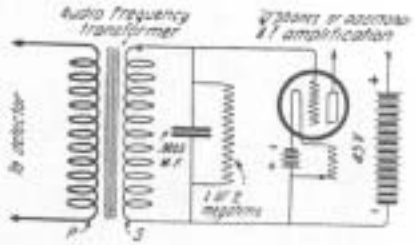
Just to the left of the set shown in the photo, stands a panel set of the very latest type and design, with five inch anti-body capacity handles on all the instruments, but the Cigar Box Set described, allows many experiments to be tried out, which could not be attempted with a fixed circuit panel receiver.

The circuit is the standard honeycomb three-coil type, except that the usual lead from the secondary to the grid, is carried in duplicate to the grids of the radio-frequency valves.

Reducing "Static"

A FORTUNE awaits the radio experimenter who can invent an effective method of eliminating what is commonly called "static."

Mr. Roy Weagant, of the Radio Corporation of America, is said to have devised a system of eliminating static, but it is generally understood to be too costly to be within the reach of the average amateur experi-



menter. Various methods of reducing static have been suggested. One amateur claims that he has improved matters by lowering his aerial to within 35 feet of the ground and by cutting out all but a single wire. He found that further improvement was made by completely shielding his receiver with a zinc case, leaving only the necessary holes for the control knobs and terminals—the zinc case, of course, being earthed. Not only did the latter reduce static, but it also did away with the hum produced by induction from electric light and power lines. Another experimenter uses a loop aerial mounted gimbal fashion, so that it was rotatable about both vertical and horizontal axes. He found that the gimbal loop aerial eliminated static to a considerable extent, improving both signal and music reception when static conditions prevailed. When the loop was swung to the horizontal plane, there was some weakening of the signals, but this could probably be remedied by adding another stage of audio-frequency.

A third suggestion for the reduction of static is shown in the accompanying diagram, by which it will be seen that a .0005 fixed condenser, and a 1 to 2 megohm grid leak are connected across the terminals of the secondary side of the first audio-frequency transformer, in a two or three set amplifier. This was tried on all the audio-frequency transformers, but the best results were obtained by using the condenser and grid leak across the secondary of the first transformer only. In addition to eliminating or reducing static, this method is said to cut out tube noises, due to oscillations of the detector, and to reduce "howling" in the amplifiers to nil. If the fixed condenser and grid leak are placed across the secondary of the first transformer, as is suggested, and a "C" battery of 12 volts in 1½ volt steps applied to all the grids in a three stage amplifier, the "howling" certainly disappears. The "C" battery is the ordinary dry cell affair, and the negative is coupled direct to the grids of all the valves in the amplifier, the positive is connected to the negative of the "A" battery.

Music from a Lampholder

THE work of the U.S.A. Signal Corps on carrier current radio, or "wired wireless" is well known. By this system radio waves can be sent over ordinary wires. This is already in use for telephone service over power and telegraph lines and for superposing two or more telephone conversations on the same wire.

As far back as 1911 an experiment was carried out at the Brooklyn Navy Yards with a crystal receiver, using one side of an electric power line as an aerial.

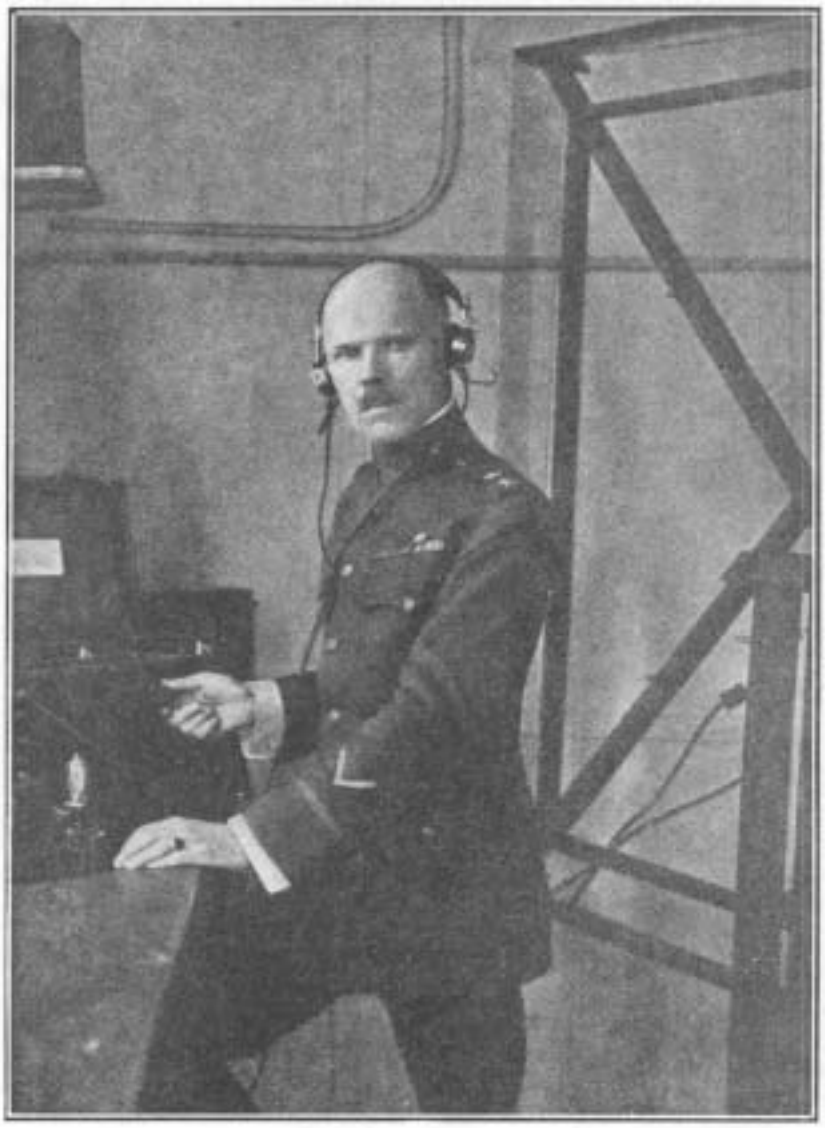
A demonstration on the efficacy of the electric lighting system as a source of news, music, lectures and speech was given in the office of the Chief Signal Officer of the United States Army, on the afternoon of October 24. The performance was witnessed by Major-General George O. Squier, Dr. Louis H. Cohen, a noted electrical engineer of the Signal Corps; R. D. Duncan, Jr., chief radio engineer, and S. Isler, assistant radio engineer, of the radio research laboratory of the Signal Corps, located at the Bureau of Standards, and other spectators.

The whole of the electric wiring system of a city may be regarded as one huge aerial, as the wires are everywhere carefully insulated from earth and every pulsation of a wireless message affects them.

Major-General George O. Squiers, of the United States Army, now proposes that outside and loop aerials be banished and the electric wiring system be used instead.

Under his directions, the American Bureau of Standards has constructed a receiving set which plugs into the ordinary electric light holder. This set has a crystal detector and radio —and audio—frequency amplification. The crystal is used as a detector as it has been found to do away with the hum of the power lines.

There is now on the market a plug which is fitted in an ordinary lamp holder. Inside the plug are two small condensers, with mica dialectric. The object of the condensers is to stop the line current, whilst allowing the high frequency radio waves to pass, enabling the experimenter to use the electric light wires as an aerial. If the plug is not readily obtainable, an efficient substitute can be made with three pairs of terminals, some low amperage fuse wire, a length of flex, a wooden adaptor, and two .001 fixed condensers. The wooden adaptor and flex serve to bring the electric light current to the first pair of terminals which are arranged on a thin piece of dry board, about two inches apart. The low amperage fuse wire connects the first pair of terminals with the second pair, the length of the fuses being three inches. The two .001 fixed condensers connect the third pair of terminals with the second pair and from the third pair, two leads are taken which are joined together on the aerial terminal of the receiving set, the usual earth connection is made from the earth terminal, or, one lead from the stopping device is taken to the aerial terminal of the set and the other to the earth



Major General Geo. O. Squier

terminal, the earth connection, in this latter case, being cut out. A .001 variable condenser in series with one or both leads from the stopping device gives better tuning, and a similar condenser may be put in series with each lead with advantage. The addition of the variable condensers minimises the risk of a short circuit from the power lines.

The diagram herewith shows the different methods that may be employed in experimenting with the "wired wireless" aerial.

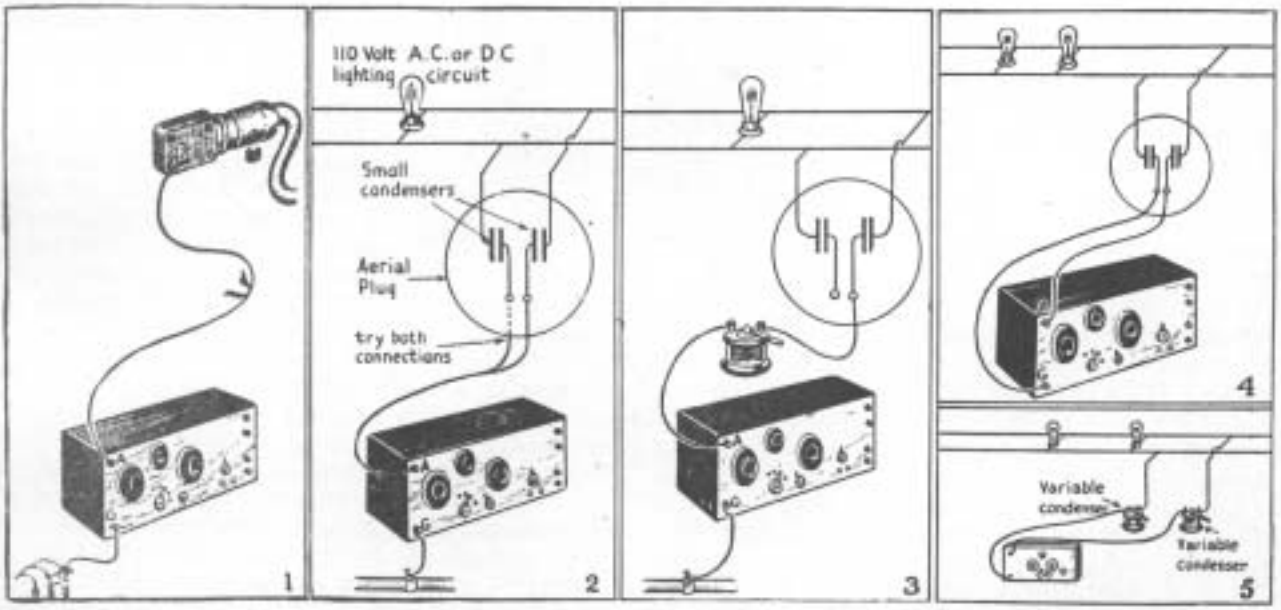
Most of us will certainly continue to use our outside or loop aerial, but there is a big field of usefulness for the electric light line aerial for those who dwell in flats, where considerable difficulty is bound to be experienced when everybody wants to receive broadcasted concert. Again, the day may not be very far distant when all leading hotels will have a concert receiver in every room, plugged into the nearest lampholder in the lighting system.

Figure 1 of the diagram shows one type of plug connected to the receiver; figure 2 gives a diagram of the construction of the plug with both leads carried to the aerial terminal. In figure 3 only one side of the light line aerial is used and a variable condenser is placed in series with it.

Both leads of the plug are taken to the receiver aerial and earth terminals in figure 4, and figure 5 has the same connections, but with the addition of a variable condenser of .001 mfds. capacity in series with each lead.

If the power line hum can be eliminated, or even reduced to a negligible quantity, the electric light line aerial will be a very convenient one to give demonstrations of radio-telephony reception with. If a two-way plug adaptor is used in connecting in the electric light line aerial, one of the lampholders can be used for the aerial, and another may perform its ordinary function of lighting a lamp.

Using the electric light wire as an aerial.



"Aerial Plugs" which are to be put into a convenient lamp socket are now quite the rage, and just how these plugs operate is evident from the diagrams herewith. Invariably the Aerial Plug contains two small condensers, preferably with mica insulation. Fig. 1 shows a simple connection of Receiving Set to ground and aerial plug in lamp socket; Fig. 2 shows complete circut through the plug, and how the aerial wire is tried on both plug terminals to find best results; Fig. 3 shows tuning improvement by placing a variable condenser in series with plug; Fig. 4 shows plug used without ground connection, while Fig. 5 shows how to duplicate performance of aerial plug with two variable condensers.

Electrons and Vibration

The following hypothetical experiment is extremely instructive, as illustrating the relationship of vibration to radiant phenomena. It is quoted from a remarkable little book entitled "Dynamic Thought," by

WILLIAM WALKER ATKINSON

"TO give one an idea of the difference produced by different rates of vibration, let us imagine a mass of iron, shaped like a great 'top', capable of being impelled to 'spin' at a constantly increasing rate of speed, by some mighty will. At first it is seen as a slowly spinning top, manifesting nothing but a slow motion to our senses.

"Now, imagine our top spinning at a rate doubling each second.

"The first second the top spins at the rate of two revolutions per second. We notice no change, except that we can see the movement. The next second the revolutions are doubled to four per second. Then, doubling each second, we have, respectively, revolutions of eight per second, then sixteen, and then, in the fifth second, thirty-two per second. Then we begin to notice a change.

"When the revolutions have reached thirty-two per second the friction of the moving top on the air causes it to give forth a very low, deep base note of **sound.** This note is like a low, deep 'hum', and is the lowest possible perception by the human hearing, although it is possible that some of the lower forms of life may be conscious of **still lower** vibrations.

"The sixth second the revolutions reach sixty-four, and the low note has grown much higher in the scale. The seventh second records a rate of 128, and the note has correspondingly increased. Then, as the seconds pass, we have successively, 256, 512, 1024, 2048, 8192, 16,384, 32,768, the latter, in the fifteenth second representing the highest note recognisable by the human ear, although it is believed that some of the lower animals may recognise sounds **too acute** for our sense of hearing.

"During this increase in revolutions from the fifth second to the fifteenth, the sound note has risen rapidly in the scale from the low sullen 'hum', on through the notes of the musical scale, and beyond the range of instruments, until the shrillness becomes so intense as to be almost unbearable, and finally terminates in a shrill, piercing shriek like the 'squeak' of a bat, only long drawn out.

"Then from the termination of the sound (by reason of the vibration having become too high) silence reigns for thirty seconds—absolute silence, in spite of the rapidly increasing rate of vibrations; in fact, **because of it.**

"Pals"

"When the forty-fifth second is reached, and the revolutions have attained the rate of 35,184,372,088,832 per second, our top begins to emit heat rays, increasing each second. Then, a little later, a dull, dim glow may be noticed. Then, as the seconds fly, the dull glow manifests a deep, dark red color, such as one notices in the iron of the blacksmith's shop, soon after it begins to glow. Then, on and on, as the seconds fly, the deep red grows lighter and brighter, gradually changing into orange, then into yellow, then into green, then into blue, then into indigo, then into violet, and then into the color of 'white heat.' Then this 'white heat' changes into a still more dazzling white, and then a white impossible to describe appears, so bright, clear and brilliant that the eye cannot bear the sight. Then suddenly, the intense brightness is succeeded by absolute darkness, and the moving top cannot be seen by the eye—and yet it moves on. The highest recorded chemical rays of light are estimated to equal a rate of vibration of 1,875,000,000,000,000 per second. The vibration of the lowest shade of red light is estimated at 450,000,000,000,000, and the highest of violet at 750,000,000,000,000 per second, so we may imagine what the highest line on the spectrum is like.

"Still vibrating, our top, which has now become a mass of vaporised iron, rapidly tends toward still more ethereal forms.

"It has passed out from the region of light-waves into another 'Unknown Region' of vibrations, in which region, however, exist the vibrations known to us as the 'X-rays,' etc. It is throwing off great quantities of **electrons.** If we were to use a fluorescent screen we would be able to observe the phenomena of the Rontgen Rays, and similar manifestations of radiant energy.

"On and on vibrates the top of what we once called iron—cold iron, warm iron, hot iron, melted iron, gaseous iron, etherealized iron, if you like. What it is like now, the imagination of man cannot conceive. Still the revolutions continue, doubling each second. What is being produced? The imagination cannot conceive of what this state of substance, now being reached, is like. By a scientific form of poetry we might think of it as melting into enérgy—pure energy, if there were such a thing. Long since it has been resolved into its original particles—its electrons, and perhaps into the 'stuff' from which these particles are made. But we must let the curtain drop—the wildest fancy cannot follow the dance of substance any further!"

The Part Played by the Atmosphere

By "X"

AS the aether wave has to travel through the atmosphere, the latter plays a very important part in determining how the wave behaves.

At the surface of the earth, dry air is a perfect dialectric; i.e., aether waves pass through it without any appreciable loss of energy.

The total depth of the shell of air that envelopes the earth is not more than about 100 miles. Its depth is therefore small when compared with the earth's diameter of 8000 miles, but we easily transmit signals for distances of 2000 miles or more. The higher we rise above the earth's surface the less heavy does the layer of air become, so that at a height of 35 miles the barometer would show a pressure of only 1 mm. of mercury.

Air at this pressure suddenly becomes a good conductor. It is so good a conductor at this pressure that a layer of air, only half an inch in thickness, will not allow a wireless wave to pass.

It is just at the height of 35 miles that the critical pressure at that point renders the air a good conductor. Below this pressure, that is, still higher from the earth, it again becomes an insulator.

Incidentally, this conducting band of air proves the impossibility of the supposed signals from other planets, in connection with which some publicity was given a few months ago, as no electric-magnetic waves could possibly pass through this band.

The upper shell of the atmosphere, then, is separated from the earth by a layer of non-conducting air, whose thickness—about 35 miles—is less than one-hundredth part of the earth's radius, and the conducting properties of the upper shell are such that it is 40 times a better conductor than is the surface of the sea, and over 600 times better than damp soil.

The reason of this conductivity is that the atmosphere is ionised by bombardment from flying electrons originating probably from the sun itself. Large ions are formed, consisting of small clusters of molecules surrounding the excess positive and negative charges.

During the night these free charges tend to reunite. When they are produced in very large numbers, however, the re-combination is incomplete. The outer atmosphere thus remains to a greater or less degree permanently ionised. In the middle atmosphere, where the ions are not produced in anything like such large numbers, the re-combination is more complete, and for the most part of the night the middle atmosphere is not ionised.

The low levels of the atmosphere are probably never sufficiently ionised to produce any appreciable effect. Besides sunlight there are other causes at work ionising the atmosphere; for example, "shooting stars" continually arriving in the atmosphere may carry with them some free electrical charges which they give up. They will also tend to keep the outer layers permanently ionised.

The path in which the aether wave is free to travel is a spherical shell, bounded on one side by the surface of the earth and sea, and on the other by the conducting layer of air. The high frequency resistance of the former is about 6600 ohms per cubic centimetre for earth, or 373 ohms per cubic centimetre for sea, while that of the latter is not more than 10 ohms per cubic centimetre.

The reason why wireless waves travel round the earth at all is that the presence of ions in the upper atmosphere gives rise to an increase in the forward velocity of the waves, while at the same time a small proportion of their energy is frittered away in heat. Thus as a wave spreads out its upper parts quickly reach the ionised layers, and move more rapidly than the lower. The wave accordingly becomes bent, the upper half being reflected more and more towards the earth. In just the same way, at sunset, the sun's rays strike the atmosphere obliquely, and being refracted, or bent, from their straight path, illuminate the surface of the earth for some time after the sun has actually disappeared.

Two very well-known facts about wireless waves are that signals are normally weaker by day than by night, and that short waves suffer a much greater decrease than do the long ones. This is because the atmosphere becomes irregularly ionised. The conducting layer does not present a nice, smooth surface for the wave to slide along, but becomes rough and jagged. Large patches of air in the middle atmosphere become ionised also.

The reflecting effect of the upper atmosphere varies with the wave length; the longer the wave the more sharply it is bent back. Thus for equal energy in the two waves the energy of the long wave will be available at the earth's surface to a greater extent than that of a short wave. The short wave may dissipate all its energy in the middle atmosphere before it is bent back to earth.

By night, however, the middle atmosphere, since it becomes de-ionised, does not affect either wave, but the strongly ionised outer layer bends both long and short waves sharply back. Neither of them, therefore, has a long path through the ionised medium, during which its energy would be absorbed. Long and short waves thus have a more equal range by night than by day. In this connection, it must be remembered that a great increase of signals by night cannot be expected from the long waves used in continuous wave systems, and while a short spark set may increase in range anything from 100 to 300 per cent., a long spark will be little, if any, stronger by night than by day, and may be more difficult to read owing to the greater prevalence of atmospheric disturbance at night. Many other observed peculiarities may be similarly explained.

It is known that long waves are better than short ones in mountainous country by day, but there is not much difference by night. This is put down to

both waves being reflected back sharply at night, whereas by day only the long waves are bent back sharply enough to penetrate the valleys.

The not infrequent irregularities of long waves by night may perhaps be due to large patches of the middle atmosphere remaining ionised. Such ionised clouds are quite possible, because during the daytime the atmosphere is in a state of continual motion, and parts may accumulate an excess of negative ions and other parts an excess of positive ions.

Re-combination cannot then take place very quickly, and these clouds remain to bend the waves in various directions. They will have a greater effect on long waves than on short ones, which may account for the long waves being more irregular.

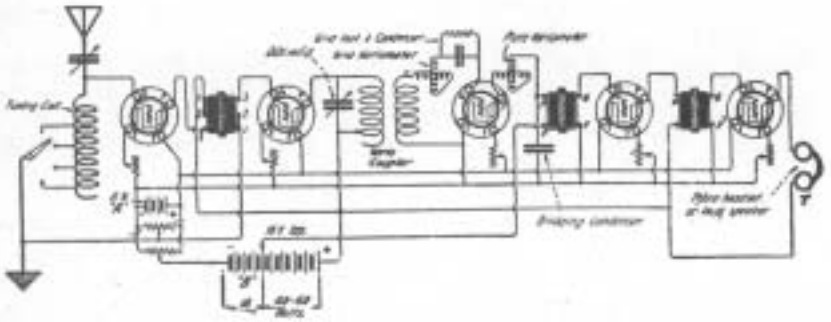
Some action of this kind may also explain the "freak" distances so often reported, the ionised clouds acting as large lenses or mirrors.

The maxima and minima of ionisation of the middle atmosphere occur at noon and 5 a.m. respectively, and these are the times at which the worst and best signalling ranges may be expected.

Radio and Audio Frequency Amplification

NOW that the Trans-Pacific Tests are in the air, a suggestion for a short wave radio and audio-frequency amplifying receiver will be timely.

Our diagram illustrates a receiving set in which one radio-frequency transformer is used with two stages of radio-frequency, the second stage being inductively coupled to the grid of the detector valve. A tapped inductance and a variable condenser form an energy absorbing circuit which feeds into the first radio-frequency valve.



A Radio and Audio Frequency Circuit

The plate of the second valve is connected to the aerial terminal of a vario-coupler, the earth connection of which is coupled to the positive side of the "B" battery. A .001 variable condenser is shunted across the aerial and earth connections. Variometers are used in the grid and plate circuits of the detector valve. There are two potentiometers, coupled in parallel round the "A" battery. One has the usual "B" battery negative lead joined to the slider, the other has a lead from the radio-frequency transformer, and this connection is earthed.

The points marked 1, 2 and 3, on the radio-frequency transformer, are for the purpose of making adjustments to suit a 200 to 500 metre wave length, or a band of 500 to 5000 metres. A brass strap connects terminals No. 1 and No. 2 together. In this position the 200-500 metre band is covered. When points No. 1 and 3 are used, with the strap disconnected from No. 1, the 500-5000 metre band is available.

This radio-frequency transformer is one manufactured by the American Radio Corporation, and is known as the UV1714. It contains two coils on a core of Alexanderson high frequency iron. Each winding has several hundred turns of fairly low resistance copper wire, with a tap taken off for the shorter wave lengths.

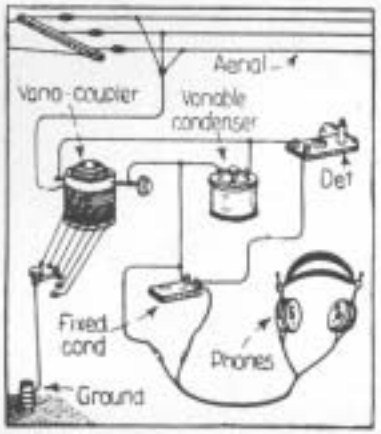
It is a splendid amplifier at all the wave lengths covered, but is especially good on short waves.

The circuit may be adapted to the honeycomb type of inductance by using the primary in the ordinary way, and coupling the secondary-to-grid-of-detector lead into the grid of the first radio-frequency valve. The secondary of the transformer is joined to the grid of the second valve and the plate is connected to one end of a honeycomb coil which is shunted by a condenser. The other end of the coil is taken on to the "B" battery positive terminal as is shown in the diagram. A similar coil has one end connected to the usual grid condenser and grid leak, omitting the variometer, and this coil may be shunted by a condenser if desired, but acts quite well without it. The coils used for coupling the plate of the second radio-frequency valve and the grid of the detector valve should be of a size suitable for the wave length to be covered. On 600 metres, 100, 150 and 200 turn honeycomb coils gave practically the same result. For the wave length mentioned, the primary was of 100 turns, the secondary 150, and the tickler 75. The tickler coil is coupled into the plate circuit of the detector valve as in the standard honeycomb coil circuit. The plate of the detector valve may be connected to .001 variable condenser shunted round the primary of the first audio-frequency transformer. If the latter course is adopted, the tickler coil is not used. It should be noted, however, that the tickler coil circuit gives the best results.

Tips for Fans

A CRYSTAL DETECTOR CIRCUIT.

A crystal detector circuit which shows the most efficient way in which to use a vario-coupler and variable

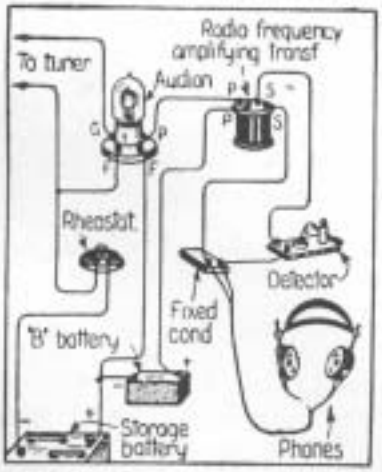


condenser with the usual phone condenser and phones. A loading coil, of the honeycomb type can be placed in series with the aerial and primary of the vario-coupler if long wave-lengths are required, the loading coil having the number of turns suitable for the wave-lengths to be covered.

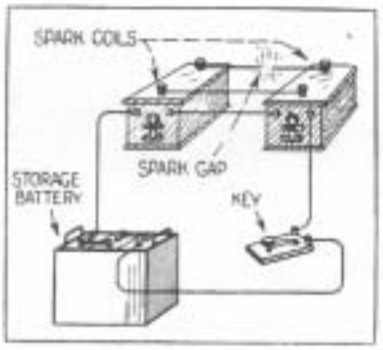
* * *

A RADIO-FREQUENCY AND CRYSTAL COMBINATION.

The circuit diagram herewith shows how to amplify radio signals

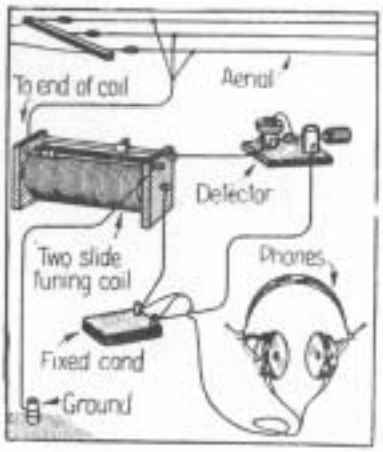


at radio-frequency and detect them with a crystal detector. If a detector valve is used the "B" battery should be of the same voltage as would be used for the valve detector, if an amplifying valve is put in circuit, 45 to 80 volts will be correct.



A BIGGER SPARK.

The illustration gives a method of coupling two small spark coils to obtain a larger spark.



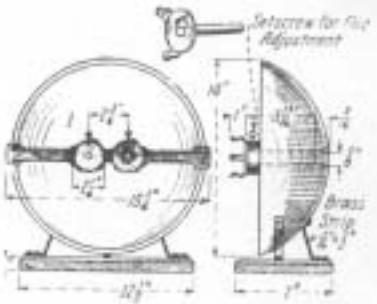
AN EFFICIENT TWO-SLIDE TUNER CIRCUIT.

Here is an efficient circuit for a crystal detector having a two-slide tuner, fixed condenser and phones.

A LOUD SPEAKER.

An easily constructed loud speaker which may also be used as a sound

collector for transmitting is made up of a wooden bowl, 14 inches in diameter, mounted as shown in the photo, on a wooden base. A strip of wood is screwed to the bowl to carry the ear-pieces of the headphones, or



to carry the microphone transmitter if used for that purpose.

Brass strips, ½ inch wide by 1/16th thick, are made into clips to carry the ear-pieces, and the microphone may be attached direct to the wooden strip.

THE GRID LEAK.

A GRID leak can be made by laying a small piece of paper on a piece of ebonite or hard wood and drawing across it with a soft lead pencil or Indian ink a line about 1½ inches long. Two brass screws put through the paper, one at each end of the line, form the terminals.

The resistance of such a line depends directly upon its length, and inversely upon its width or thickness.

For such a grid leak blotting-paper is perhaps the most suitable.

Another form of grid leak is made from a piece of slate pencil with metal-capped ends, the resistance again depending upon length and diameter.

Though by no means a necessity, a little experimenting will go to show that a grid leak is a very useful accessory in spite of its easy construction. The resistance most generally accepted for the small unit is between two and four megohms in value, a megohm being equal to one million ohms.

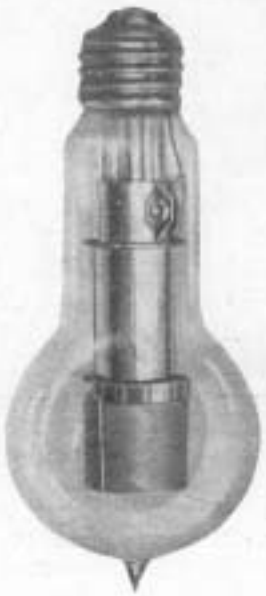
A Rectifier Valve without a Filament

THE "S" valve, known as "the valve without a filament" has caused widespread comment throughout the scientific world. It is a rectifier of alternating current of any frequency, and is ideal for radio-telephone or telegraph transmitting sets.

The capacity is 20 watts and the voltage it will handle runs from 300 to 750. It is intended for operation with any standard C.W. transformer of 200 watts rating or lower. Two valves are required to rectify both halves of the A.C. cycle. The filament heating winding, included in most transformers for operating rectifying valves, is not used with the "S" valve, which functions on the principle of gaseous conduction instead of electron emission from a heated element. Two of the valves provide a normal output of 40 watts —100 milliamperes at 400 volts— which is sufficient to operate two standard 5 watt power valves at rated capacity.

Additional 5 watt power valves can be operated by employing the proper number of "S" valves in parallel, in combination with a 500 ohm series resistance in each valve circuit. The valve is intended to pass not more than 50 milliamperes continuously.

As the rating of each valve is 20 watts the number of valves required for a desired output is easily calculated. If it is necessary to rectify higher voltages than the 300 to 750 volt range provided for, the "S" valves may be coupled in series.



The average life of the valve has not been determined, but as there is no filament to burn out, it is practically everlasting.

A peculiar feature of the valve is that when it is operating there is nothing that can be seen, and the heating of the bulb is the only indication that a load is being carried.

WORTH NOTING.

Keep your accumulators upright. Sulphuric acid has an undesirable effect on one's best carpet.

If you are very close to a transmitting station, don't tune in for loudest signals. It is not good for the 'phones.

If you have a valve set and it suddenly ceases to function, don't jump to the conclusion that it is a "dud." Probably your filament accumulator wants charging.

See that your valve circuits are not causing radiation. By this is meant, don't experiment with strange circuits until you know what you are doing.

Keep an eye on your lead-in tube. Damp will cause bad insulation and poor signals.

Keep your earth lead as short as possible. This applies to aerial down leads as well.

Don't varnish or paint your apparatus. It won't look any the handsomer in the end, and will probably spoil it.

Avoid a gas-pipe earth—especially if you have a transmitter. The reason is obvious.

A lead-covered roof will make a good "earth." This is due to a "dissipating" effect.

Transmitting Circuits

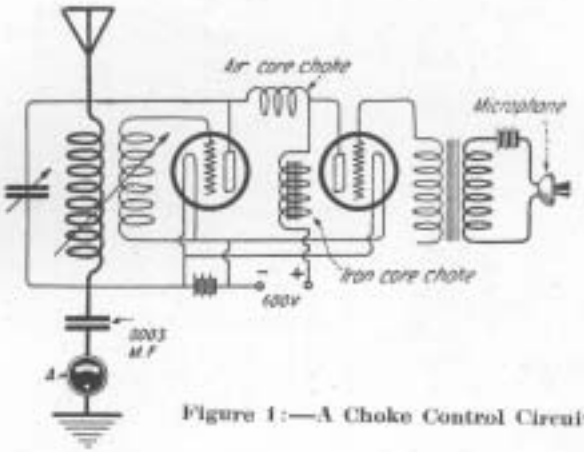


Figure 1:—A Choke Control Circuit.

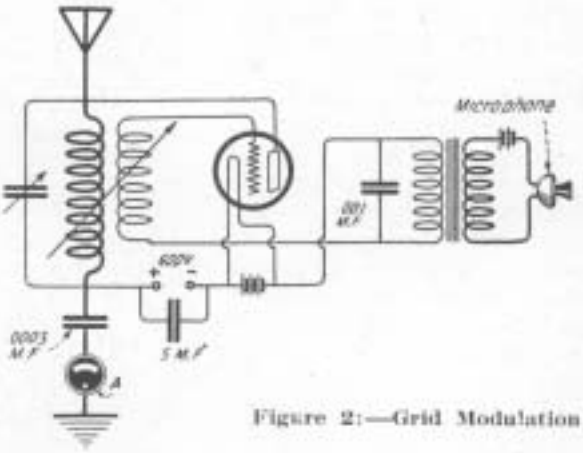


Figure 2:—Grid Modulation

NOW that amateur transmission is to be permitted, C.W. circuits will be carefully conned over, and most of us are looking forward very eagerly to the time when we can filter the ether in the evenings and find something coming in to try out the new receiving circuit on, or, on the other hand, to contribute our quota to the general good by sending out radiophone or c.w. to enable the other fellow to try out his receiver.

Here are three transmitting circuits. Figure 1 employs the choke control system. Figure 2 is a grid modulation circuit. Figure 3 shows a honeycomb coil circuit practically as used in a receiver set, the rotary converter taking the place of the "B" battery of the receiver circuit. Electrolytic rectifiers in conjunction with a transformer may, of course, take the place of the rotary converter, or a two-electrode valve rectifier, or one of the gas conduction type, as described elsewhere in this issue, may be used, whilst the a.c. hum or growl is said to be effectively banished by using the Mershon Electrolytic Condenser, the latter taking the place of the choke coils and high capacity of the filter circuit.

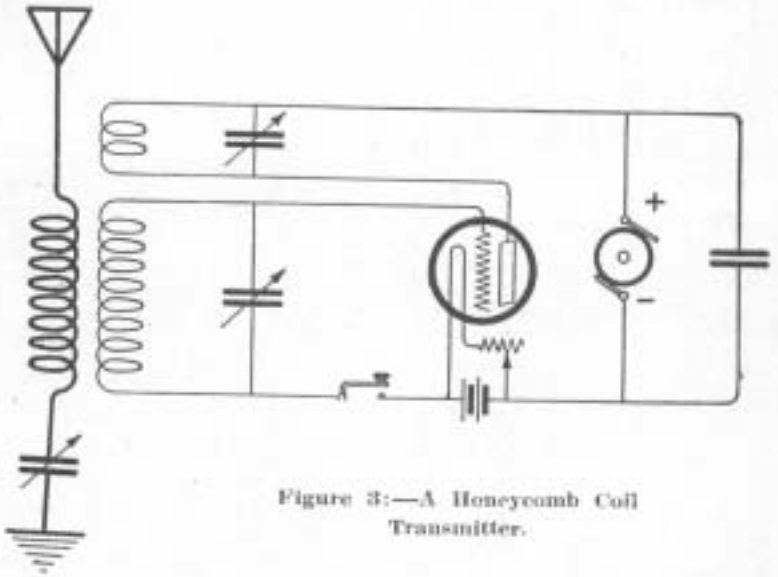


Figure 3:—A Honeycomb Coil Transmitter.

Improved Microphones

"UNDER the auspices of the National Institute of Inventors, of Sackville Street, a new type of microphone transmitter has been developed which is free from the disturbing elements associated with carbon transmitters," says "The Daily Telegraph." "The variations in resistance accompanying the usual vibration of a thin diaphragm are accomplished by the movements of an electrode in glowing neon gas, which gives both an invariable value of the resistance when the vibration amplitude is zero, and a large proportional change in resistance when vibration takes place. It appears that owing to the nature of the conductor —an electron stream—there are no inertia effects, and the speech is transmitted with great clearness. The microphone should prove of service in radio-telephony circuits, for a more perfect modulating device is badly needed for this purpose. Meanwhile it has already been applied to the production of sounds produced and synchronised with films. A photographic record of light variations, produced by the use of the microphone and a vacuum tube, is printed by the side of the cinema picture, and reproduction of the accompanying sounds obtained by selenium and a system of amplifiers."

Abolishing the Battery

SEVERAL attempts have been made from time to time by various experimenters and radio engineers to operate vacuum tube receiving sets on alternating current, such as we have in our homes for lighting lamps and supplying heat for electric cooking apparatus, but as there is usually a considerable humming noise present when the sets are operated on alternating current, unless very finely tuned and balanced, the average radio enthusiast has stuck to his storage and dry batteries to supply the necessary filament and plate currents.

The employment of a crystal detector, such as galena, may seem objectionable to those who have had experience with crystal detectors in general, owing to the fact that they are liable to get out of adjustment or become insensitive quite frequently, but this investigator has found many meritorious features in crystal detectors, when used in connection with a V.T. amplifier of two or more stages. For one thing the crystal detector used in place of a V.T. detector reduces the 60-cycle hum very considerably. As Mr. Lowell further points out, it is not necessary to make very careful adjustment of the crystal detector with the circuit, because the radio-frequency amplification preceding the detector usually gave sufficient signal strength so that a point of satisfactory sensitivity could easily be found. The crystal detector gave approximately as good amplification as the V.T. detector. Still better amplification and quieter operation was produced by using a ten-volt "C" battery in the grid circuit of the first audio-frequency stage. In some of the earlier experiments a plate "B" battery was used for convenience, but this was finally replaced by alternating current which had been rectified by means of an electron tube, and smoothed out by condensers with large capacities, as shown in the accompanying diagram.

Referring to the complete circuit of the five-stage V.T. amplifier with crystal detector, shown, it is seen that either a loop aerial or the regular out-door antenna may be employed. The outside antenna is here shown, used in connection with a vario-coupler or loose coupler, for tuning the signal or speech to a maximum strength. This amplifier is

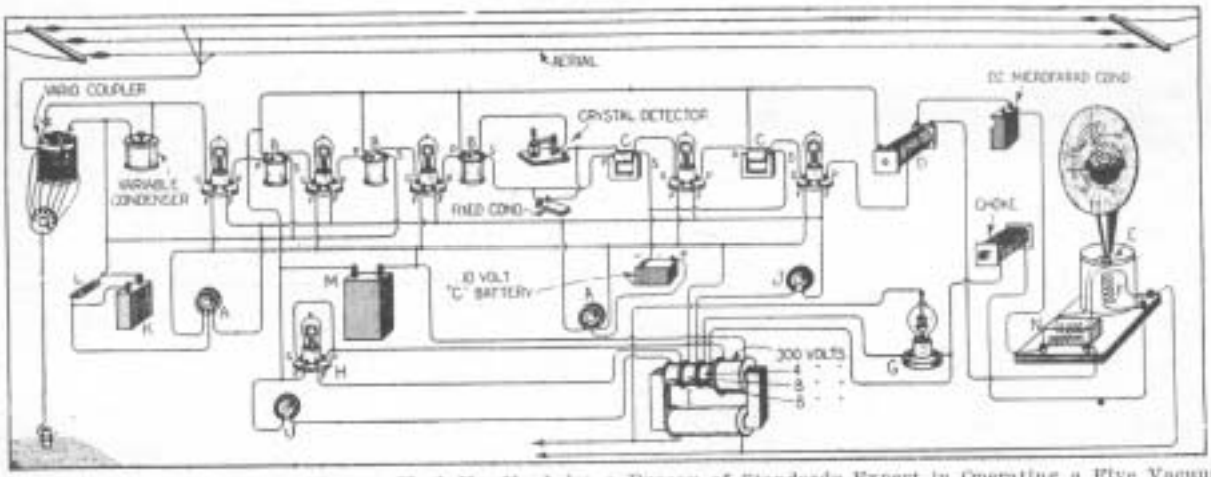


Fig. 1.—This Diagram Shows the Latest Hook-Up Used by a Bureau of Standards Expert in Operating a Five Vacuum Tube Receiving Set on 110 Volts, 60 Cycle Alternating Current, the Voltage Being Stepped Down Through a Suitable Transformer as Shown. The Letters in the Diagram Correspond With the Following Apparatus: A, Balancing Resistance; B, Radio Frequency Transformers; C, Audio Frequency Transformers; D, 1 to 1 Ratio Telephone Transformer; E, Armature of Loud Speaker; F, Field of Loud Speaker; G, Tungar Rectifier; H, Plate Voltage Rectifier; I, Power Transformer; J, Filament Rheostats; K, Condenser, 1 Microfarad; L, Leak Resistance, 2 Megohms; M, Smoothing Condenser, 10 Microfards; N, Step-Down Transformer for Loud Speaker.

One of the U.S. Bureau of Standards radio experts, Mr. P. D. Lowell, has carried out some very interesting and startling experiments in the operation of a five-stage V.T. amplifier with crystal detector on 110 volts, 60 cycle A.C., and has reduced the residual hum due to the A.C. practically to zero, or to such an extent that it is not noticeable with ordinary strength of signals or speech. Mr. Lowell's contribution to science appears in the July number of the "Journal of the American Institute of Electrical Engineers," and one of the most interesting facts brought out by Mr. Lowell is that more noiseless and perfect operation of vacuum amplifiers was obtained with the filaments lighted from low voltage A.C. supplied by a step-down transformer, than was given when the filament current was rectified through rectifier tubes.

not of the regenerative type, as here shown, but it has been found effective for the reception of undamped waves, etc., when used with a separate V.T. heterodyne. The five V.T's. used for amplifying in the first three radio-frequency stages and in the last two audio-frequency stages should be U.V. 201 amplifier tubes or their equivalent. The first three transformers are radio-frequency units, while the transformers connecting the two audio-frequency stage V.T's and the crystal detector are iron core audio-frequency transformers. A small condenser of about .01 M.F. is placed across the primary of the audio-frequency transformer connected with the crystal detector as shown. It was found

advantageous to couple the Magnavox loud-talker to the plate circuit of the fifth V.T. by means of a one-to-one ratio telephone transformer, D in diagram. A .02 M.F. condenser was connected in series with this telephone transformer, and with the primary terminals of the Magnavox transformer N, which is found mounted on the base of this type of loud-talker. E is the moving coil of the loud-talker, while F is the field magnetizing coil of the Magnavox, with a choke coil connected in series with the filament and plate of a Tungar rectifier, G. The impedance of the field coil was found sufficient to smooth out the pulsating current, so that the hum was not annoying. This hum was further reduced by the aforementioned one-to-one transformer and series condenser, shown in the diagram.

The rectifying tube H, for the 300 A.C. for the plate may be a Tungar tube, or else a three-electrode audion with the plate and grid connected together, as shown, to form the cold electrode for rectifying. The large condenser M is of ten microfarads capacity and may have waxed paper or mica dielectric, but preferably mica. The experimenter might try different arrangements than this, using a high voltage D.C. dynamo to supply the plate current, for example.

The balancing resistances or potentiometers A have about 200 ohms resistance. All of the V.T's. in the amplifying stages have their filaments controlled by a power rheostat from the 8-volt A.C. circuit.

The low A.C. potentials required may be supplied by properly connecting to the terminals of a toy step-down transformer of suitable size, using a plate "B" battery; or else a small transformer having a 250 to 300 volt secondary, or this can be made readily by connecting a suitable sized spark coil secondary unit and a suitable primary winding on a closed soft iron core formed of wire or sheets. For the 300-volt transformer an iron core audio-frequency transformer may sometimes be used, if the primary is sufficiently heavy to stand 110 volts, 60 cycle A.C. A choke coil may have to be used in series to prevent burning it out, and of course this can be determined by a little experimenting. The choke coil used in series with the Magnavox field winding may comprise 1200 to 1500 turns of No. 24 insulated magnet wire, wound on a laminated sheet iron core one-half inch square, by five inches long. A large condenser connected in shunt to the choke coil and field coil of the loud-talker, would no doubt prove efficacious. This could very well be tried until the best capacity is obtained.

Power transformers for working direct off the A.C. current, are now listed in the catalogues of the American manufacturers.

Taps are provided for the filament of the valve, for the rectifying valves, and for the plate potential. " These are intended for transmission purposes, but, they could be used with equal facility for the purpose of abolishing the batteries in the amplifier described herein.

Radio Music for Dancing Classes

The day may yet come when the whole of the dancing classes of a State will be able to sway to the music of a single orchestra. The Hotel Commodore in New York City, U.S.A., has just completed the installation of a radio receiving set and a loud speaking telephone outfit that is attracting considerable attention, particularly among the dancing masters of the East and others who see in it the possibilities of buying their music from one central source just as they obtain their light and heat and power.

The amplifying and loud-speaking apparatus, which has been installed by the Western Electric Company as part of the permanent equipment of the hotel is similar on a smaller scale to that used at Madison Square Gardens on Armistice Day when 38,000 people in and about the building were able to take part in the service. Projectors have been placed at various points in the ball room and connected through vacuum-tube amplifiers to the radio set. The antenna on the roof of the hotel picks up music sent out by the broadcasting

Sydney Technical High School Radio Club Enthusiasts

stations and passes the waves through an ordinary type of receiving set in which they are amplified. The power amplifiers then increase the strength of these signals.

"I have been much interested in this demonstration of dance music by radio," says Joseph O'Brien, President of the Dancing Masters' Association, in discusing the Commodore equipment. "First class music for dancing is essential if we are to please our patrons and this kind of music costs us real money. It is an obvious waste for a hundred academies to employ a hundred orchestras if they can connect by radio with a central station which transmits dance music. If such a station were established, it could readily afford the best orchestra in the world—one made up entirely of top-notchers. Yet the cost to each subscribing academy would be less than its present pay roll. Of course, this would not eliminate local musicians because there always will be a need for them to furnish music for instruction and special dancing."

The Electron Valve

A WELL-KNOWN scientist found that when he inserted a little metal plate in an electric bulb, and passed a current through the filament wire so that it glowed white hot, a curious thing happened.

A galvanometer (which is an instrument used for detecting the passage of electric currents), when connected in the plate circuit, registered the passing of a current by means of a deflecting needle or pointer, which moves under the influence of electricity.

As there was no metallic connection between the filament and the plate, he believed that a current leapt the gap between the filament and plate. He also discovered that the "leaping effect" could only be procured when the connections to the valve from the battery were made, positive to plate, negative to filament.

When the battery connections were reversed, the galvanometer needle did not move.

Now, when the filament was heated, a stream of electrons were shot off it towards the plate, being attracted to it because it possessed a charge of the positive "sign," while the electrons were all negative.

These charges of unlike "sign" attracted one another.

The electrons, upon arriving at the plate, continued on their way through the wire to the positive terminal of the cell, and in passing through the galvanometer on their journey caused it to register their passage as described.

When the circuit was altered so that the metal plate was connected to the negative side of the battery, no attraction was offered to the electrons in the filament, because charges of a like "sign" repel each other. The electrons did not, therefore, travel to the plate; but once we give the plate a charge of the opposite sign, the attraction becomes evident.

The fact that two negatively charged objects will always repel each other, but that a positively charged object attracts a negatively charged one, is thus carried out, and if the plate is connected as stated above, it will collect a good proportion of the negative electrons.

In view of what has already been said regarding electricity of different signs, it is easy to understand that if, instead of merely intercepting the electrons, we attract them by giving the plate a charge of the positive "sign," a greater number of electrons will be induced to leave the filament and travel to the plate.

We know that this can be accomplished by connecting the plate to the positive side of the battery from which the filament is heated.

It should be observed that the flow of electrons is possible in one direction only, namely, from the filament to the plate, and is in the opposite direction to that in which electric currents are generally presumed to flow.

Let us now add a much larger battery to the circuit, the strength of which can be varied by a "resistance," and attach its positive terminal to the plate so as to attract almost all the electrons possible from the filament. Then, we have succeeded in setting up a flow of electrons dense enough to suit our purpose, let us insert another plate—a perforated one this time—known as a "grid" to act as a barrier to the electrons trying to get to the outer plate from the filament.

The perforated plate or grid, under the influence of the electrons, becomes "negatively" charged; but as there are holes in it, some of the electrons will continue to pass through to the outer plate. If we now connect the grid to a wireless aerial, what effect does the incoming oscillation or wireless wave have upon the valve?

We must bear in mind that a complete incoming wave is composed of one negative and one positive half, and it therefore sets up oscillating currents in the receiving aerial, i.e., currents which swing or oscillate to and fro, and in so doing vary from a positive to a negative potential with inconceivable rapidity.

So swiftly do they alternate, in fact, that the diaphragm of the human ear cannot move quickly enough to keep in time with them, and they are therefore inaudible to human beings.

When oscillations of this nature arrive at the grid of the valve from the aerial, they immediately cause a change of current values in the plate circuit of the valve. The steady flow of electrons between the filament and plate still takes place, despite the shielding influence of the grid, and any variation of the negative character of the grid will increase or decrease the number of electrons constituting the "flow."

As the incoming signal varies from a negative to a positive value, the "screening" effect of the grid is alternately strengthened and weakened by such signals.

When the negatively charged grid is strengthened, less electrons are passed to the plate than normally, and when it is weakened, a greater electronic flow to the plate takes place.

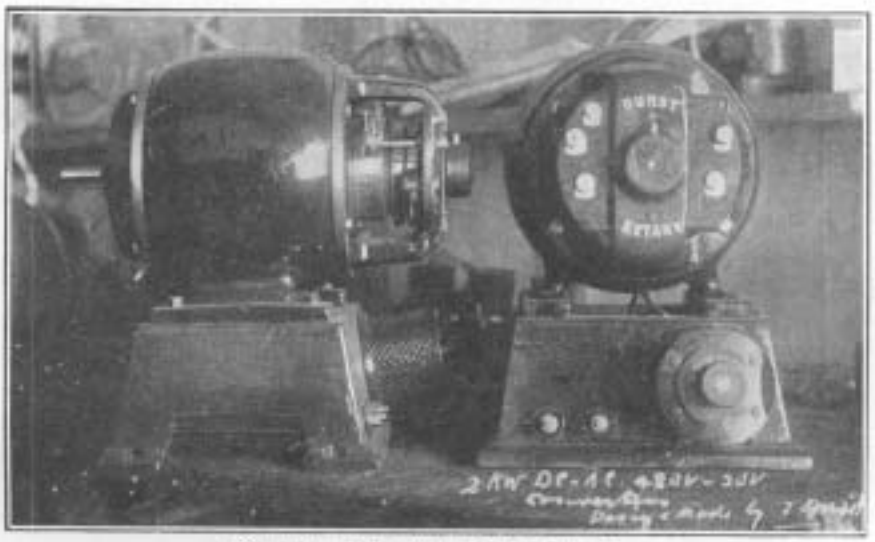
Th action of the grid might be likened to a leaky sluice gate, which is opened wide one instant and closed tightly the next, thereby regulating the flow of water, which can be likened to a flow of electrons.

If certain relative values of plate and filament current are placed on the valve, the amount of electrons passing through the grid to the plate can be so regulated that one half of the incoming oscillation will influence the plate circuit to a much greater extent than the remaining half, which will have almost no effect at all.

What is tantamount to a series of unidirectional "pulses" are therefore induced into the plate circuit, and these can be rendered audible by the inclusion of a pair of telephones at a suitable point.

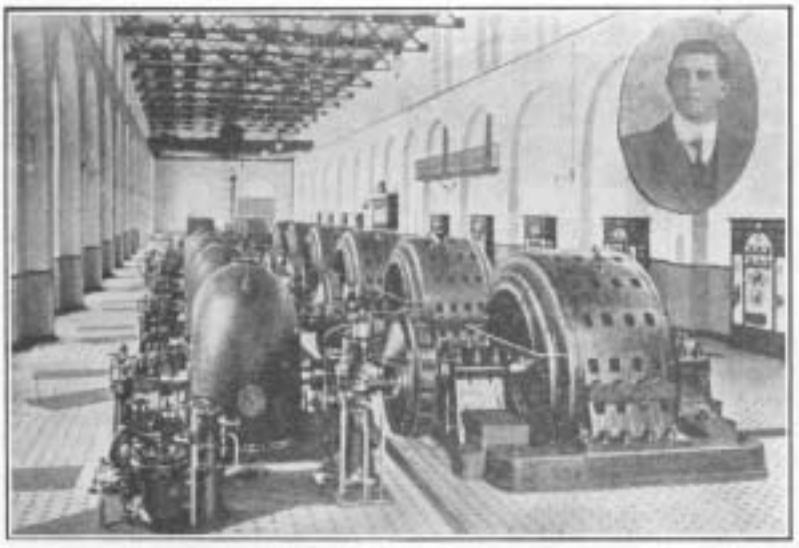
An Efficient Rotary Converter

THOSE of our readers who contemplate the installation of a transmitting set will be pleased to know that they can obtain an efficient rotary converter, for supplying 300, 400, or 500 volts d.c. to the plate of the transmitting valves, without the vexatious delay inseparable from importing such a machine.



Side and end view of the Rotary Converter.

Mr. John Durst, Electrical Engineer, of 72 Liverpool Street, Sydney, N.S.W., is manufacturing a rotary converter having three taps for the voltages mentioned above. The commutator segments are large, ensuring freedom from sparking at the high voltages, and the laminations are very thin, to ensure maximum efficiency. Our illustration gives a side and end view of the machine. We include a photo. of a large lighting plant erected by Mr. Durst at Bruzio, Switzerland, whose ability as an electrical engineer is vouched by the fact that he holds the diploma of the world-renowned Hale University.



Electric Lighting Plant at Bruzio, Switzerland, erected by Mr. J. Durst.

If you require a helix or any kind of winding for your experiments, Mr. Durst is at your service. You will be received with kindly courtesy, and he will turn you out a good job.

As transformers are now designed to supply the plate potential and current for both filaments and rectifying valves, or plate potential only, the amateur transmitter may prefer to employ a transformer instead of a rotary-converter. In that case, an electrolytic rectifier is necessary if a rectifier valve is not used, and either an electrolytic rectifier or a transformer of any pattern will be made up by Mr. Durst on request, who can lay just claim to being a specialist on transformer construction.

The Inventive Craze

HARDER still, perhaps, than keeping track of all the new uses for radio is keeping up with the new achievements and inventions which are being made at a perfectly bewildering rate. There are, for example, over a thousand applications for patents before the United States Patent Office at the present moment. Not all of them, by any means, will be granted, but it can be seen that new ideas are being developed all the time. A very interesting piece of apparatus is that produced by a young New York amateur, who has evolved a detector tube which requires no batteries. It consists of an evacuated glass tube containing a synthetic chemical substance with suitable electrodes.

The inventor claims that not only will it give, with one stage of audio-frequency amplification, results equal to the ordinary detector with two stages, but that it is free from all rectifier distortions common to the regular triode tube.

Apparatus and Appliances

THE EXIDE BATTERY.

THE heart of the receiving set is an efficient "A" battery. None but the best will do, for the slightest drop in the voltage renders the receiver as dead as the proverbial door-nail. It takes a good battery to stand up to the work of running a set with, say, two or three stages of

radio-frequency, a detector valve, two or three audio-frequency valves, and a loud speaker. A battery worthy the name should be capable of running such a set for at least eight hours continuously, maintaining full voltage all the time. This is exacting service, but the Exide will stand up to it. Exide plates are the last word in battery construction. It has finely cast compact grids, which are uniformly pasted with chemically correct material to give them strength, stability and durability. The separators are made of a tough and durable wood, which is subjected to a specialy developed treating process which eliminates elements injurious to the battery, and ensures constant service and long life. A test cell was stored fully charged in 1911. Once a year it has been given a freshening charge, standing on open circuit from year to year. In 1920 it gave 17 ampere hours at 1 amp discharge, in 1922 it gave 19 ampere hours, so that after remaining for 11 years on open circuit, it now gives 90 per cent. more than its listed capacity, which was 10 ampere hours.

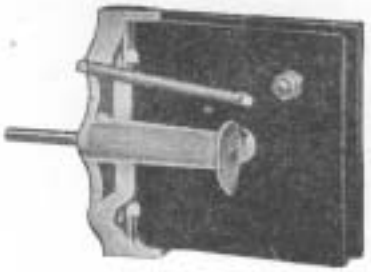
To those who know what it means to have a battery standing on open circuit and only charged once a year, nothing more need be said; but to the uninitiated, we would point out that a battery which will come successfully through such a drastic test is the one likely to give the greatest satisfaction for wireless work. Firms like the Marconi Co. of London, and the British Thompson Houston Co., place orders with the Exide people to the extent of 10,000 batteries at a time.

The Exide Battery may be obtained from Messrs. Gibson, Battle & Co. Ltd., "Exide" Battery Service Station, and Delco-Remy Service Station, Hunt Street, off Wentworth Avenue, Sydney, N.S.W. The Manager, Mr. O. J. Wilkinson, will be pleased to furnish radio fans with full information regarding the "Exide." The firm handles all electrical accessories for motor-cars, and employs more than 20 hands.

* * *

THE CROSSLEY VARIABLE CONDENSER.

THE Crossley variable condenser is a departure from the ordinary type, and has two leaves of copper foil separated by a sheet of mica. These leaves are mounted on wooden carriers, and variation is obtained by separating them, suitable means being provided. Two models are



available, one for reception and the other for transmission. For the latter it is claimed that they are especially suitable, as they are much less liable to break down or shower than is the ordinary air-dialectric condenser. They are of .001 to .0005 capacity, with a minimum capacity of .00006.

THE BRADLEYSTAT RHEOSTAT.

THE construction of the Bradleystat recalls the carbon block rheostat of lab. days. It will be remembered that slabs of carbon three inches square by half an inch thick were placed in a frame, at the end of which a wheel-handled screw exerted more or less compression on

the blocks, according to the resistance required. The Bradleystat is constructed in a similar manner, and has graphite discs, which are compressed or released by a suitable screw arrangement.

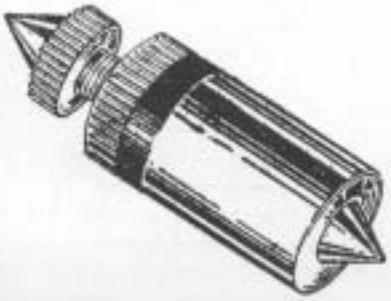
The regulation is very fine, much finer than with a vernier rheostat. Those using amplifiers know how necessary it is to use vernier rheostats on all the valves.

* * *

THE Universal Electric Co., 58 Wentworth Avenue, has opened up with a splendid range of radio goods. There are variometers, variocouplers, loose couplers, duo-lateral and honeycomb coils, Remler-Giblin coils, a specially fine line of condensers, both knock-down and assembled; all types of valves, including the Cunningham and Radiotrons. In headsets, Stromberg-Carlson's, Baldwin's and Murdock's figure prominently. Amongst the sundries are intervalve transformers, moulded valve holders, fittings of all descriptions, and a robust-looking "B" battery fitted with brass terminals at all tappings, and which gives one a very healthy "kick" across the outer connections.

A NEW AUTOMATIC CRYSTAL DETECTOR.

ANOTHER important wireless invention is that of the New System Telephone Co., who have placed upon the market an automatic crystal detector. This new detector is made up in cartridge form, like a small fuse, and is held between two clips. The leading feature of the invention is that instead of depending on means of finding one sensitive spot on the crystal, a number of points of contact



are always available, consequently the detector is automatic in its adjustment, as one of the points of contact can be relied upon to provide the necessary rectifying action at maximum sensitiveness.

The Everset Automatic Crystal Detector has been produced by the Company's engineers at the works at Dulwich, London, England, and it comes as a real boon to those who desire to have clear and distinct radio concert reception at a small cost. The usual procedure of having to find the most sensitive spot on a crystal, and tune in the concert at the same time, is done away with, as is the failure of the crystal at a critical moment. With the Everset Automatic Crystal Detector, all that is necessary is to tune in the radio concert—the crystal is always ready.

The Company list what is called the "Crystal Set No. 4." This is fitted with the Everset Patent Automatic Crystal Detector, and two stages of audio-frequency amplifying valves—an ideal combination for clear concert reception. This set synchronises with the advent of the electric light line aerial, as the crystal detector eliminates all power line hum, and should be the ideal receiver for those living in flats or where it is not convenient to erect an outdoor aerial.

At the Radio Exhibition recently held in London, the Company's exhibit attracted a great deal of attention, the receiving apparatus on view ranging from small crystal sets, single valve receivers, one and two stage amplifiers to de luxe cabinets, made up in gramaphone cabinet form, with loud speakers in the base. It is anticipated that the full range of the wireless apparatus will be on hand by the time this article appears. In the manufacture of radio headsets, the Company's engineers have a quarter of a century of experience in this line behind them, and no expense has been spared to render T.M.C. Headsets, the best it is possible to produce.

They are procurable in 120, 1000, 2000, 4000 and 8000 ohm resistance. The insulation is the highest possible, the magnets are of selected tungsten steel, manufactured by the Company's own process, and the headsets are guaranteed for ten years.

The Sydney address of New System Telephones is 280 Castlereagh Street, and 54 Market Street, Melbourne.

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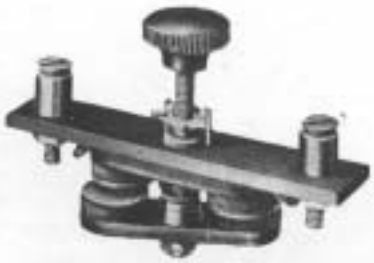

A VERNIER VARIOMETER.

THOSE who use the vario-coupler-variometer type of inductance for short wave reception will appreciate the neat little vernier variometer shown in our illustration. It gives the same regulation as a vernier condenser, but has the advantage that it will not introduce capacity.

* * *

EBONITE SUPPLIES.

The Colonial Rubber Co., Ltd., of Sydney, New South Wales, are now turning out a very fine grade of ebonite for radio apparatus purposes. The surface permits of it being matted with fine glasspaper for making up panels—and experimenters will remember that eminent radio engineers favor a matted surface to minimise the chance of leakage.

The sheet ebonite may be had in the usual thicknesses, and knobs, condenser dials, condenser tops and ends, honeycomb coil connectors, are all obtainable. The ebonite employed for all purposes will take on a very fine polish if required, such as for condenser dials, etc., and it is very easily worked in the lathe. The company supply direct to the trade only.

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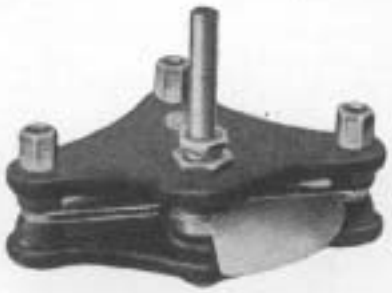


A VERNIER CONDENSER.

IN receiving music or speech, a vernier condenser, shunted across the terminals of the secondary condenser, gives much finer tuning and is an acquisition to any receiving set. The photo is that of an "Amrad" Vernier Condenser.

* * *

BELL TRANSFORMERS AND RECEIVING SETS.

THE man who first constructed a bell transformer was struck with an exceedingly happy thought. It was the story of Columbus and the egg all over again. There was the a.c. current; there was the bell with its messy, troublesome, always-out-of-order battery. Why not jettison the battery and all its woes, and link the a.c. to bell service? Why not? And it was done! Nothing to get out of order, bells always in service, and everybody wondered why it had not been done before.

Then a radio fan said, "Give me a bell transformer, give me the juice, and leave the rest to me." So he joined up the bell transformer to his receiving set, putting a potentiometer across the 6-volt terminals, and connected the slider to the negative of the "B" battery and did away with his "A" battery. He says that the bell transformer lights his valve

filaments through rheostats in the usual way, and that the potentiometer cuts out the a.c. hum.

A very compact bell transformer, measuring only 2 x 3 inches, and having three tappings giving 6, 8, or 14 volts, is obtainable at The General Trading Co., Broughton House, King Street (near Clarence Street), Sydney. This firm has just secured the agency for a splendid line of wireless goods, which are manufactured in Melbourne, the quality of which is equal to the best radio goods imported.

They are also importers of English Ebonite.

* * *

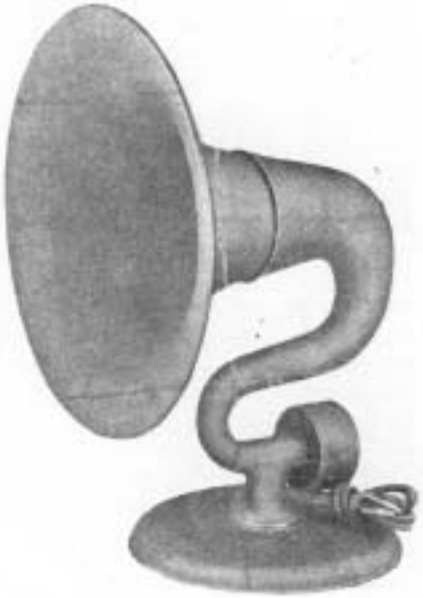
THE MERSHON ELECTROLYTIC CONDENSER.

THIS condenser solves the filter problem. It is of high capacity—30 mfd. per unit. For 5 watt sets two condensers are coupled in series. The condensers alone, connected across the source of rectified a.c., provide a filter equal to the usual 2 mfd. condenser, double choke and by-pass condenser, and they effectively eliminate the disagreeable a.c. hum.

* * *

THE "CLEARTONE" VOICE AMPLIFIER.

THE "Cleartone" loud speaker is a strongly built and attractive looking piece of apparatus, that gives a clear and perfect reproduction of the human voice, and exceptionally fine rendering of concert and orchestral music. The construction is such as to produce a scientifically graduated amplification of sound waves, and is the result of the long experience of the Dictograph Corporation's engineers in sound reproducing mechanism. The earpieces used in the sound box of the amplifier have a resistance of 1500 ohms. The bell of the horn is finished in antique bronze and the lower part of the horn and the base in black



lacquer. The "Cleartone" will meet the requirements of those who want to fill a fair-sized room with radio concert music, with a loud speaker obtainable at a moderate cost.

The Dictograph Corporation turns out a very fine grade of radio headsets also. Both the "Cleartone" Voice Amplifier and the Dictograph Headsets are stocked by Mr. Harry Wiles, of 60 Goulburn Street, Sydney.

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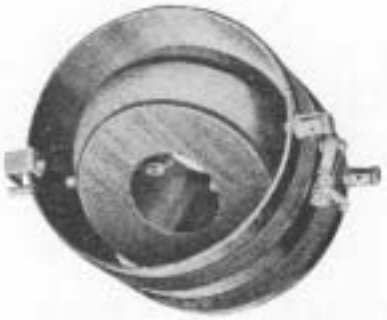


THE DAYTON VARIOMETER.

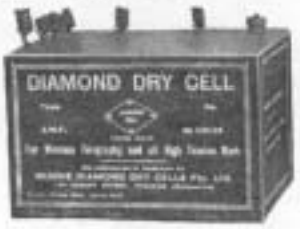
THIS variometer is the type used in the Armstrong Super-Regenerative circuit, and is placed above, and in inductive relation to an inductance wound on a bakelite tube, 4 inches high by 3 inches diameter, with 60 turns of d.c.c. wire.

* * *

THE PLATE CURRENT PROBLEM.

WITH the advent of the valve into the radio world, the dreams of Bellamy's "Looking Backwards" have been realised, so far as regards story, song and music, being brought to every home "through the air."

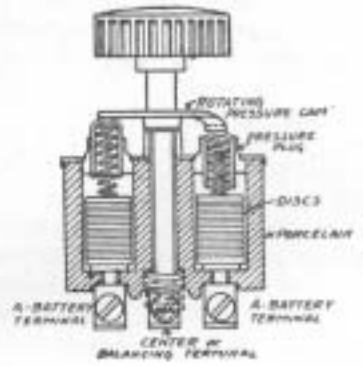
Wonderful as have been the developments in radio science since the three-electrode valve was invented, still more wonderful will be the progress of the next few years, as already we have a valve capable of handling 100,000 watts of power, with which continents may be linked, and conversation over thousands of miles of ocean made possible. As compared with the crystal receiver, however, the valve presents certain difficulties. For the valve, current must be supplied for the filament,



and for the plate. The filament supply is easy to arrange as an ordinary accumulator serves admirably.

For the plate of the valve, a voltage of anything from 10 to 150 may be required, and the problem has been how to supply this range of pressure. Fortunately, the current necessary is almost negligible—just a few milliamps—so the dry cell type battery is available. At first, a number of flashlight batteries were joined together, but compact blocks of cells, yielding convenient voltages, and carefully insulated against dampness, are now obtainable. The "Ducombe" Battery, which bears the well-known "Diamond" brand, is made in Melbourne, by the Widdis Diamond Dry Cells Proprietary, Ltd.; the voltage on the outside terminals is 30, and taps in between give variations of this pressure.

The "Ducombe" is a very high-grade battery, it sells at 18/- retail, and is obtainable at Australectric Ltd.



THE BRADLEYOMETER.

SIMILAR to the graphite disc rheostat in make-up, the Bradleyometer is a potentiometer with the fine adjustment qualities of the rheostat. The photo shows the construction and how it is connected in the circuit.

* * *

A BANK-WOUND VARIO-COUPLER.

THE bank-wound vario-coupler will be a popular type of inductance for concert and speech reception. The one illustrated is 5¼ inches long,

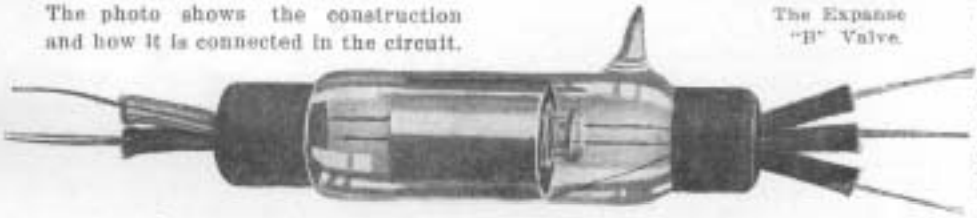
with an outside diameter of 3 3-8 inches. The range of wave lengths by taps, using a .001 variable condenser, is from 150 to 2800 meters.

A RADIO VALVE MADE IN AUSTRALIA.

IT is to the credit of Australasian manufacturers that their one aim in life is to turn out goods equal to those made in any part of the world —and the manufacturers of the "Expanse B" Valve are no exception to the rule. The Company's engineers have been hard at work perfecting the valve, and have now attained that degree of super-sensitiveness so much to be desired. The great feature of the latest type is that it has two separate filaments which need only be burnt at dull red in order to make the valve oscillate. The filament current is approximately only .75 amps., and the plate potential between 20 and 35 volts.

The "Expanse B" is manufactured by Amalgamated Wireless (Australia) Ltd., and the sole distributors are Australectric Ltd., 97 Clarence Street, Sydney.

The Expanse "B" Valve.



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THE DE FOREST RADIOPHONE VALVE RECEIVER.

IN the radio world the name De Forest is one to conjure with, for everyone will remember that it was Dr. Lee De Forest who invented the three electrode valve as we know it to-day. How that valve revolutionised radio reception, and, later, transmission, is now a matter of common history. As the inventor of the valve, none more competent to turn out a valve receiver than Dr. Lee De Forest, and in the "Radiophone" Receiver is embodied everything which has been suggested by years of the most practical kind of experience. The enterprising Burgin Electric Co. have the "Radiophone" on hand, and it sells at the modest price of £22/10/-. In addition there are large stocks of De Forest, Remler-Giblin and other honeycomb and duolateral coils with a full list of all radio accessories.

People who are Waiting to Talk "Wireless" with You

MR. J. S. MARKS, General Manager of Electricity House, 387 George Street, Sydney, N.S.W., has been in charge of the business ever since its inception, and by sheer energy and

Mr. J. S. Marks

initiative has built up one of the largest electrical supplies houses in the city of Sydney.

He is a very whole-hearted radio experimenter and has traversed the road that leads to multi-valve sets by the vehicle of the crystal detector receiver. His present receiver, a fine product of the firms manufacturing department, has a detector valve and two stages of audio-frequency, the intervalve transformers being also made by the firm, and one has only to hear the set in operation to realise that we can manufacture in Australia, intervalve transformers equal to anything that is imported. The inductances consist of a bank-wound vario-coupler, with both primary and secondary tappings, and available for wave lengths from 150 to 6000 meters, loading coils increasing this range to 25,000 meters. Quite a number of the leading citizens of Sydney have been entertained with radio concerts by means of Mr. Mark's receiver.

When news of the radio boom came to hand, the possibilities in Australia were quickly realised by Mr. Marks, who immediately added a radio department to the business. At first the radio department was but a small affair, but it has grown very rapidly, and a spacious workroom, fitted with modern plant and machinery, has been acquired, in which nine workmen concentrate on the construction of radio apparatus. Altogether, twenty hands are employed, some of whom are engaged in the construction of electrical and steam models—a branch of the business in which the firm has gained a great reputation. Parents have begun to realise that the right way to direct the growing boy's thoughts into useful channels is to put into his hands some mechanical toy or model which will really "go." Electricity House models are made to go, they are practically and efficiently made.

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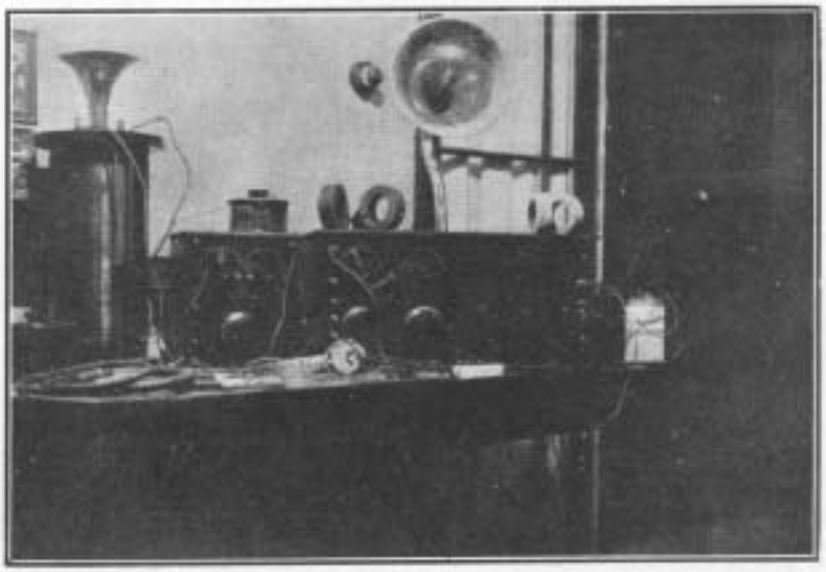
IN our last issue we stated that Mr. Raymond H. Shaw, the Manager of the Radio Department at Electricity House, George Street, was not on board the Helen B. Stirling, at the time the vessel was wrecked. We now ascertain that he was on board, and that he was the operator who sent out the distress signals.

MR. F. BASIL COOKE is the son of Professor W. E. Cooke, M.A., Government Astronomer at the Sydney Observatory. He is the manager of the new Radio Company, which has opened up at 18 Elizabeth Street, Sydney, where receiving and transmitting sets and all radio apparatus will be available. Mr. Cooke is fully seized of the fact that the Australian amateur is one of the most critical of experimenters, and that nothing but the best and most practical of apparatus will meet his requirements, so the stock of radio goods will be built up accordingly. During the war he was in charge of the Wireless Instruction Department at Moore Park, and later at Liverpool.

Thousands of men passed through his hands, most of whom went out as wireless operators to Mesopotamia and Egypt. In training these men, it was necessary to design a course which would impart the maximum of knowledge in a minimum of time, and so well did he succeed that he was congratulated on what he had achieved by the General commanding the Mesopotamian Forces.



Mr. J. S. Marks' Receiving Set

As well as supervising the sales department of the Company, he will be the Director of the Radio College, which will be one of the Company's activities. The syllabus of the College has been planned to cover the requirements of amateurs who wish to qualify for the tests necessary to obtain the Government licenses, and, in addition, it is hoped that the information imparted will help to render him a skilled radio expert, and a useful citizen, who may render valuable service should the necessity arise.

Mr. Cooke can claim to be the second wireless experimenter in W.A., having started his experiments long before a wireless station was erected, and prior to the date on which licenses were first issued. He was the first to receive Continental and American signals in Australasia.

At the Observatory his work was largely in connection with the reception of time signals from the powerful station at Lyons, France. These signals were the same as received at Greenwich, and from which the Sydney longitude was worked out.

Students at the College will have the benefit of access to a three-valve receiver, and may make up his own set, using the standard set as a model.

Mr. F. B. Cooke

Mr. J. I. Carroll, is the Sydney manager of the New System Telephone Proprietary Ltd., at 280 Castlereagh Street, and Mr. E. Holloway, the Company's Managing Director for Australia, is at 54 Market Street, Melbourne. The Telephone Manufacturing Company Ltd. is the parent Company in England of the New System Telephones Proprietary, Ltd., of Melbourne and Sydney. "T.M.C." and "N.S.T." are, therefore, synonymous terms.

* * *

T.M.C. telephone appliances are known throughout the length and breadth of Britain for their high quality and dependability. During the past few years, the skill of the Company's engineers has been exercised in the development of radio apparatus of the same high grade as the telephone apparatus. The gentlemen mentioned above will have for your inspection a full range of T.M.C. radio goods, from small crystal sets to loud speaker cabinets de luxe—every article finished in the inimitable manner of the British manufacturer.

Radio Club Activities

LEICHHARDT AND DISTRICT RADIO SOCIETY.

THIS Society is now in full swing, and the greater portion of each Tuesday evening meeting is devoted to some practical aspect of radio science, which amateurs and experimenters in the district should secure the benefits of. The acquisition of the Morse code is being given particular attention and a number of interesting and informing lectures have been delivered, the subjects including:—"The Construction and Action of Loose Couplers," by Mr. Bird; "Crystal Detectors and their Action," "The Construction and Action of the Telephone Receiver," and "A Few Points on Magnetism," by Mr. Zech, (Hon. Secretary).

The officers elected are:—President, Mr. F. Morrison; Vice-Presidents, Messrs Bird and Ross; Hon. Treasurer, Mr. W. Bird; Hon. Secretary, Mr. W. J. Zech; Assistant Hon. Secretary, Mr. W. Bird; Councillors, Messrs. L. A. Harrison, C. L. Cantrill, E. J. Harrington, and H. Kirkpatrick.

* * *

ILLAWARRA RADIO CLUB.

FORTNIGHTLY meetings of the club are held, where lectures, demonstrations and talks on constructional details are given for the enlightenment of members. Regular buzzer practice is being instituted, and the Technical Committee is arranging a comprehensive syllabus of lectures and demonstrations for the year to enable the members, particularly the beginners, to gain the necessary technical knowledge to construct and operate sets, and qualify for their licenses under the new regulations. It is the club's intention to install both transmitting and receiving sets at an early date. With commendable enterprise and initiative, and as a means of augmenting the club funds, a combined picture show and wireless entertainment was arranged with the proprietors of Tolley's Pictures, Kogarah. The music was transmitted by Mr. C. D. Maclurcan; Mr. C. A. Gorman, a member of the club, operated a receiver of his own construction and design, and delighted the audience with clearly rendered items via a loud speaker. The Secretary, Mr. W. D. Graham, 44 Cameron Street, Rockdale, cordially invites anyone interested to attend the club meetings. The club-room is at Mr. McNeill's residence, 75 Montgomery Street, Kogarah. The club is represented on the Council of the Radio Association of Australia, New South Wales branch, by Mr. Gorman.

In the big district served by the Illawarra Club, there must be many good amateur singers and instrumentalists, who would be glad to lend a hand at a weekly broadcasted musical programme, and we make the suggestion to such an enterprising club, that when the transmitting set is installed, a weekly programme be sent out, to delight the hearts of all the radio fans within range. To fill up gaps, one of the phonographic companies will probably loan a grammophone and the necessary records —voice records for preference.

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THE MARRICKVILLE AND DISTRICT RADIO CLUB.

A CLUB has been formed in the above district, and the following officers were elected pro tem:—President, Mr. S. Farrell; Hon. Secretary, Mr. R. G. Ellis; Committee, Messrs. F. A. Scott, G. W. Round, E. Walton, H. W. M'Quoiti and R. G. Ellis.

The Club meets at the rear of 14 Park Road, Marrickville.

KURINGAI RADIO SOCIETY.

THE Kuringai District Radio Society is another new Club with the following officers:—President, Mr. W. W. Wilson; Vice-Presidents, Messrs. H. Stowe and O. F. Mingay; Hon. Treasurer, Mr. R. Hinton; Hon. Secretary, Mr. R. Wiltshire; Committee, Messrs. P. Renshaw, Wooldridge

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WAVERLEY AMATEUR RADIO CLUB.

THE Waverley Radio Club has elected its officers for the next six months, and they are as follows: President, Mr. E. Bowman; Vice-Presidents, Messrs. D. Williams and G. Gatham; Hon. Secretary, Mr. G. Thompson; Treasurer, Mr. E. Lavington; Committee, Messrs. A. Burrows and F. C. Perry; Librarian, Mr. W. Singleton.

Communications to the Hon. Secretary, Mr. G. Thompson, c/o Mrs. Wills, Macpherson Street, Waverley. 'Phone, Waverley 1508.

* * *

CANTERBURY INTERMEDIATE HIGH SCHOOL CLUB.

A CLUB has been formed in connection with the Canterbury Intermediate High School, and a receiving licence has been applied for. Apparatus is under construction, and a series of lectures is being arranged. Master Jack Quirk is the Hon. Secretary, and communications should be addressed to him, c/o the School.

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ARMIDALE RADIO CLUB.

A RADIO CLUB has been formed at Armidale, and has elected as its officers the following:—Patron, Mr. A. Purkiss; President, Rev. H. S. Buntine; Vice-Presidents, Mr. T. Flynn, Rev. Canon Rily, Mr. P. C. Hipgrave, and Mr. H. A. Marshall; Hon. Secretary, Mr. E. Barlow; Hon. Treasurer, Mr. P. Knight; Committee—Rules: Messrs. Flynn, Knight, N. R. Cottrell and V. Mallom; Technical: Messrs. Flynn, Cottrell, W. Scott and B. Haynes; Finance: Messrs. M'Leod, Knight, Hipgrave and Bigg. The Club intends to install a transmitting set.

Radio Fans Everywhere

THE Great Amateur Radio Association of the United States, with its **hundreds of thousands of members**, owes its success to the fact that it had the backing of a widely circulated journal, which insistently demanded that every facility should be granted the Amateur Wireless Experimenter to tread the highways and byways of radio research.

That journal forced upon the attention of the "powers that be" that the free use of the ether was the birthright of every American citizen!

THE AUSTRALASIAN WIRELESS REVIEW is going into every city, town, hamlet or village in Australasia through a well-known publications distribution agency.

We want you to help us make THE AUSTRALASIAN WIRELESS REVIEW a power in the land, so that we can impress upon the attention of the powers that be in Australasia that we must have the same privileges that are enjoyed by experimenters in other countries. We intend to make THE AUSTRALASIAN WIRELESS REVIEW the biggest and brightest and most informing wireless magazine in the world. We want to give you, at an early date, a review at least twice the size as at present at the same price.

Now the very backbone of any magazine is its subscription list. We want subscribers.

Three or four thousand subscribers mean to the publishers that many copies definitely sold of each month's issue. From time to time news stands sales of the Review can be gauged, and the two factors taken together enable the publishers to decide to what extent they can increase the size of the Review and so give you more value for your money. But, remember that the subscription list with its definite sales is the main factor.

Interest your friends in THE AUSTRALASIAN WIRELESS REVIEW. Send us along their subscriptions. You would like to have your copy of the Review promptly posted to you every month, and so save yourself the disappointment of being told that your newsagent is sold out.

THE AUSTRALASIAN WIRELESS REVIEW will come promptly to your door each month as soon as it is published. And it will cost you less!

Send along **15/-** for a full year's subscription, and bring the Review under the notice of your friends, whether they are radio experimenters or not, and so help to hustle the radio boom along!

The biggest service you can render our wonderful radio science is to get everybody interested. The best help you can render your Wireless Review is to send us along subscriptions. Don't delay. The sooner we have a full subscription list the sooner we can give you more value for your money!

A long pull and a strong pull and a pull altogether, and we will place Australasia on the map with regard to progress in radio science.

Enclose a postal note to-day for **15/-** for one year's subscription, post free, to any part of Australasia.

Address the envelope to:

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Name in (full) .....

Address (*Giving number of house where possible*) .....

I enclose herewith **15/-** *(Fifteen Shillings) for ONE YEAR'S SUBSCRIPTION to "THE AUSTRALASIAN WIRELESS REVIEW." To be forwarded to me each month POST FREE.*

Signature .....

To the Publishers of "THE AUSTRALASIAN WIRELESS REVIEW," 304 Kent Street, Sydney, N.S.W., Australia

Our Monthly Photographic Competition

Very many Wireless Experimenters are also photographic enthusiasts; others have amateur photographer friends who will co-operate with them in sending in exhibits for the monthly competitions of

"The Australasian Wireless Review"

Every month we offer a prize of ONE GUINEA for the best photo of an amateur wireless set in any part of Australasia. TEN SHILLINGS AND SIXPENCE will be paid for the SECOND BEST, and FIVE SHILLINGS for the THIRD. A SPECIAL PRIZE OF TEN SHILLINGS AND SIXPENCE will be awarded for the best radio novelty photograph.
The prizes to be awarded for the best Wireless Sets may be won by those possessing any kind of Set, Crystal or Valve; efficiency, neatness of workmanship and quality of photograph, being the leading factors to be taken into account.

The PRIZE of 10/6 for the NOVELTY PHOTOGRAPH will be awarded for the best photograph of any novel picture or scene in which a radio receiving apparatus is used. Pretty garden party scenes, children listening in, animals hearing radio concerts, &c., suggest themselves as amongst the suitable subjects.
A full description of the competing set to be forwarded, together with wiring diagram of same if possible.

Full names of people, and full description of the photo appearing in novelty photos section is desirable.

All photographs to be the property of the Proprietors of The Australasian Wireless Review. The Editor's decision to be final.

Photos may be sent in at any time, and all the photos to hand by the first of each month will be included in the following month's REVIEW COMPETITION.

Here is the opportunity to win a guinea, half a guinea, five shillings, or the special prize of half a guinea, and at the same time to let your fellow experimenters know what you are doing in your section of Australasia.

Send your photo in To-day! *Do not Delay!*

Printed and published in Australia by W. PIERPONT BLACK & CO., 304 Kent Street, Sydney, N.S.W., for the proprietors of the "Australasian Wireless Review," 304 Kent Street, Sydney.—February, 1923